# Pluggable Hardware Installation Guide

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# Preface

## Conventions

This section discusses the conventions used in this guide.

## Text Conventions

The following tables list text conventions that are used throughout this guide.

**Table 1: Notice Icons**

| Icon | Notice Type | Alerts you to... |
|---|---|---|
| | Note | Important features or instructions. |
| | Caution | Risk of personal injury, system damage, or loss of data. |
| | Warning | Risk of severe personal injury. |
| | New | This command or section is new for this release. |

**Table 2: Text Conventions**

| Convention | Description |
|---|---|
| Screen displays | This typeface indicates command syntax, or represents information as it appears on the screen. |
| The words **enter** and **type** | When you see the word "enter" in this guide, you must type something, and then press the Return or Enter key. Do not press the Return or Enter key when an instruction simply says "type." |
| **[Key]** names | Key names are written with brackets, such as [Return] or [Esc]. If you must press two or more keys simultaneously, the key names are linked with a plus sign (+). Example: Press **[Ctrl]**+**[Alt]**+**[Del]** |
| *Words in italicized type* | Italics emphasize a point or denote new terms at the place where they are defined in the text. Italics are also used when referring to publication titles. |

## Platform-Dependent Conventions

Unless otherwise noted, all information applies to all platforms supported by ExtremeXOS software, which are the following:

- BlackDiamond® X8 series switch
- BlackDiamond 8800 series switches
- Cell Site Routers (E4G-200 and E4G-400)
- Summit® family switches
- SummitStack™

When a feature or feature implementation applies to specific platforms, the specific platform is noted in the heading for the section describing that implementation in the ExtremeXOS command documentation. In many cases, although the command is available on all platforms, each platform uses specific keywords. These keywords specific to each platform are shown in the Syntax Description and discussed in the Usage Guidelines.

## Terminology

When features, functionality, or operation is specific to a switch family, the family name is used. Explanations about features and operations that are the same across all product families simply refer to the product as the "switch."

# Related Publications

Documentation for Extreme Networks products is available at: www.extremenetworks.com. The following is a list of related publications currently available:

- *ExtremeXOS User Guide*
- *ExtremeXOS Hardware and Software Compatibility Matrix*
- *ExtremeXOS Legacy CLI Quick Reference Guide*
- *ExtremeXOS ScreenPlay User Guide*
- *Using AVB with Extreme Switches*

- *BlackDiamond 8800 Series Switches Hardware Installation Guide*
- *BlackDiamond X8 Switch Hardware Installation Guide*
- *Extreme Networks Pluggable Interface Installation Guide*
- *Summit Family Switches Hardware Installation Guide*

- *Ridgeline Installation and Upgrade Guide*
- *Ridgeline Reference Guide*

- *SDN OpenFlow Implementation Guide*
- *SDN OpenStack Install Guide*

Some ExtremeXOS software files have been licensed under certain open source licenses. Information is available at: www.extremenetworks.com/services/osl-exos.aspx

## Providing Feedback to Us

We are always striving to improve our documentation and help you work better, so we want to hear from you! We welcome all feedback but especially want to know about:

- Content errors or confusing or conflicting information.
- Ideas for improvements to our documentation so you can find the information you need faster.
- Broken links or usability issues.

If you would like to provide feedback to the Extreme Networks Information Development team about this document, please contact us using our short online feedback form. You can also email us directly at internalinfodev@extremenetworks.com.

# 1 Licensing Requirements

**Optical Interfaces Licensing Requirements**
**Licensing of Third-Party Optical Modules**

## Optical Interfaces Licensing Requirements

The following notes describe the licensing requirements for 40G and 100G optical interfaces used in Extreme Networks hardware.

**Caution**
Beginning with EXOS 15.4, customers adding new unapproved third-party 40G or 100G optical interface modules to their Extreme Network switches will receive an informational message via SNMP/ Syslog. This message will indicate that they have an unapproved third-party 40G or 100G optic and that in EXOS 15.5 a third party 40G/100G feature license will be required for full functionality of the new hardware. Customers can purchase a feature license to remove this warning message.

**Caution**
Beginning with EXOS 15.5, customers will need to purchase a feature license to achieve full functionality of new unapproved third-party 40G or 100G optical interfaces. If customers do not purchase the feature license for these new modules, they will receive an informational message via SNMP/ Syslog. This message will indicate that they have an unapproved third-party 40G or 100G optic and that a feature license is required for full functionality of the new hardware. Customers will have 90 days to obtain the feature pack before the port's egress bandwidth is rate-limited to 25% of line rate.

**Warning**
Extreme Networks authorized and certified optical modules are tested to work in all supported Extreme Networks hardware and switching equipment. Extreme Networks does not provide any warranty or compliance statement pertaining to any third-party non-approved hardware. Use of non-approved optics modules and corresponding interface modules is solely at your own risk and without any liability, warrant, or service obligation by Extreme Networks. Extreme recommends use and integration of only manufacturer certified hardware as expressly referenced within the applicable Extreme Networks product documentation. In addition, any non-approved third-party optic modules in use by you shall be compliant with all regulatory standards as applicable to the location of operation that may include but not limited to NRTL, FCC CFR 21 1040.10, CDRH Letter of Approval, CE marked, EN60825-1 and or GR-468.

# Licensing of Third-Party Optical Modules

Extreme Networks optical modules are tested to work in all supported Extreme Networks switches. We recommend that all customers use Extreme Networks optical modules in their Extreme Networks switches. Extreme Networks assumes no liability for third-party optical modules. Although Extreme Networks does not block third-party optical modules, we cannot ensure that all third-party optical modules operate properly in all Extreme Networks switches. The customer assumes all risks associated with using third-party optical modules in Extreme Networks switches.

Extreme Networks' recommended policy is for its customers to purchase Extreme authorized and qualified optical devices as further described on Extreme's then-current price lists. Historically, Extreme Networks customers were not technically restricted from integrated use of non-approved 3rd party optical devices to attach to high-speed ports. In keeping with standard industry practices, to maximize overall product quality and reduce servicing challenges, Extreme Networks will restrict the integration of non-qualified 3rd party optical devices within 40G and 100G product environments, unless you purchase the EXOS 3rd Party 40G/100G Optics feature license to allow such integration.

> **Note**
>
> Pursuit of such integration remains outside of Extreme's standard committed terms of product warranty and support Direct customer support for such usage of high-speed unapproved 3rd party optical devices will continue to be limited, and considered out of scope.

The use of 1G and 10G optic devices by customers is not affected by this new Feature Pack use requirement.

Extreme Networks' policy regarding the use of 3rd Party Optics can be viewed in our Pluggable Interface Modules Installation Guide, and related policies, located here: www.extremenetworks.com

This EXOS 15.5 release creates a new requirement for customers to purchase a feature license pack named "3rd Party Optics Feature License". Like other feature-pack licenses, once you apply the license to a specific switch, the feature is enabled for the life of the switch. Without such a license, switches with 40G and 100G hardware ports that are inserted with unapproved 3rd Party optics modules will have 90 days before the egress traffic on that particular port is automatically limited to 25% of line rate.

> **Note**
>
> The restriction is flagged by show port conf command output, and warningmessages are issued when 3rd party 40G and 100G optical devices are inserted. The restriction is lifted when the "3rd Party Optics Feature License" license is installed.

> **Note**
>
> Purchase of an "EXOS 3rd Party Optics Feature License" seeks to enable the unrestricted use of unapproved 3rd party 40G & 100G optical transceiver for the life of the switch.

The purchaser of the "EXOS 3rd Party Optics Feature License" is solely responsible for the use of optic devices that are compliant with applicable standards and safety requirements. The use of non-compliant optic modules may result in damage to the equipment or personal injury. Extreme Networks does not provide any warranty or compliance statement pertaining to any third party non-approved

hardware, including unapproved 3rd party optic modules. See applicable hardware manual for more detail of these requirements.

The EXOS 3rd Party 40G/100G Optics Licensing feature has the following caveats and restrictions:

- The system reads and interprets the license information, and maintains a flag that indicates the presence of the optics license.
- When you insert the optical transceiver, if the 3rd Party optic license is installed no further action is necessary.
- If the device is an Extreme optical transceiver no further action is necessary.
- If the optical transceiver is restricted, the system sets a flag, R.
- If the optical transceiver is restricted, the system installs an egress rate limiter of 25% associated with the port.
- If the device is restricted, the system generates a warning EMS message that indicates the restriction.
- If you remove the optical transceiver, the following conditions occur:
  - The system unsets the flag that indicates a restriction in the port.
  - The system removes the egress rate limiter associated with the port, or restores a configured one.
- When you enable a port, the following conditions occur:
  - The system determines if the port is restricted.
  - The system generates a warning message to a console with restricted ports.
  - The system generates a warning EMS message that indicates a restriction.
- When you enable a license, the system reads and interprets the new license information. If it determines the optics license is now active, and it was not active before, the following conditions occur:
  - Sets the "optics license" present flag.
  - Searches the port list for restricted ports.
  - Removes the egress rate limiter associated with the port, or restores a configured one.

> **Note**
> This feature requires you to coordinate with other Extreme corporate processes, including how to generate a license generation and how to purchase a license

All platforms that support 40G and 100g optical devices are supported with this feature. The current list of devices subject to restriction includes:

- QSFP+ SR4
- QSFP+ LR4
- QSFP+ Passive Copper 0.5m Cable
- QSFP+ Passive Copper 1m Cable
- QSFP+ Passive Copper 2m Cable
- QSFP+ Passive Copper 3m Cable
- QSFP+ Passive Copper 5m Cable
- QSFP+ Active Optical 10m Cable
- QSFP+ Active Optical 20m Cable
- QSFP+ Active Optical 100m Cable
- QSFP+ to SFP+ Fan Out Passive Copper 3m Cable

- QSFP+ to SFP+ Fan Out Passive Copper 5m Cable
- QSFP+ to SFP+ Fan Out Passive Copper 1m Cable - QSFP+ end
- QSFP+ to SFP+ Fan Out Passive Copper 2m Cable - QSFP+ end
- CFP2 LR4
- CFP2 SR10

# 2 Extreme Networks SFP and SFP+ Modules

Overview of SFP and SFP+ Modules
Types of Optical SFP and SFP+ Interfaces
Prepare to Install or Replace an SFP Module
Install an SFP Module
Connecting Fiber Cables
Remove an SFP Module

## Overview of SFP and SFP+ Modules

Extreme Networks switches and routers support small form factor pluggable (SFP) interface modules, also known as mini-GBICs. Extreme Networks devices support both optical and copper SFP and SFP+ modules. The type of switch, router, or other component determines the compatible type of SFP or SFP+module.

Use only Extreme Networks-certified SFP and SFP+ modules, available from Extreme Networks, in the SFP port on the switch or router.

## Types of Optical SFP and SFP+ Interfaces

Extreme Networks switches support many interfaces. This includes the following types of optical SFP and SFP+ interfaces:

- SX and Industrial Grade SX SFP modules (see SX and Industrial Grade SX SFP Modules)
- LX and Industrial Grade LX SFP modules (see LX and Industrial Grade LX SFP Modules)
- ZX SFP module (see ZX SFP Module)
- 1000BASE-BX bidirectional SFP modules (see 1000BASE-BX Bi-Directional SFP Modules)
  - 1000BASE-BX-D
  - 1000BASE-BX-U
- 100FX SFP module for Gigabit Ethernet ports (see 1100FX SFP Module for Gigabit Ethernet Ports)
- Dual-speed 100FX/1000LX SFP module (see Dual-speed 100FX/1000LX SFP Module)
- LX100 SFP module (see LX100 SFP Module)
- 100BASE-LX10 SFP module (see 100BASE-LX10 SFP Module)
- 100BASE-BX bidirectional SFP modules (see 100BASE-BX Bi-Directional SFP Modules)
  - 100BASE-BX-D
  - 100BASE-BX-U

- 100FX SFP module for 100-Mbps Ethernet (fast Ethernet) ports (see 100FX SFP Module for Fast Ethernet Ports)
- SR SFP+ (see SR SFP+ Module)
- LR SFP+ (see LR SFP+ Module)
- ER SFP+ (see ER SFP+ Module)
- LRM SFP+ (see LRM SFP+ Module)
- ZR SFP+
- 10/100/1000BASE-T copper SFP and industrial grade module

The information in this guide about hardware platform support for each type of SFPs is current as of the date this guide was published. Support for specific SFP types may have been added to other switches or I/O modules besides those listed in this guide. For current information about hardware support and the minimum required software for SFPs, refer to the most recent version of the ExtremeXOS Hardware and Software Compatibility Matrix.

Technical specifications for all SFP modules are listed in Technical Specifications.

## SX and Industrial Grade SX SFP Modules

The SX (part no. 10051) and Industrial Grade SX (part no. 10051H) SFP modules provide a 1000BASE-X optical connection using LC connectors and multimode fiber cable up to 550 meters long.

The SX SFP module conforms to the 1000BASE-SX standard.

The SX SFP module operates at a commercial temperature range (-40C to 70C). The Industrial Grade SX SFP module operates at a wide temperature range (-40C to 85C).

SX and Industrial Grade SX SFP modules are supported in the following Extreme Networks devices:
- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- BlackDiamond 10808 switch
- BlackDiamond 12800 series switches
- BlackDiamond 20800 series switches
- Summit X150 series switches
- Summit X250e series switches
- Summit X440 series switches
- Summit X450 series switches
- Summit X450a series switches
- Summit X450e series switches
- Summit X460 series switches
- Summit X480 series switches
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series switches
- E4G series routers (Ethernet ports)
- Summit WM3000 series controllers

*Optical Budget Calculation*

When you plan an installation using the SX SFP module, Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors and operating margin.

There is no minimum attenuation or minimum cable length restriction.

For technical specifications for the SX and Industrial Grade SX SFP, see Technical Specifications.

## LX and Industrial Grade LX SFP Modules

The LX (Part No. 10052) and Industrial Grade LX (Part No. 10052H) SFP modules provide a 1000BASE-X optical connection using LC connectors and single-mode fiber (SMF) cable up to 10 km long.

The LX SFP module conforms to the 1000BASE-LX standard.

The LX SFP module operates at a commercial temperature range (-40C to 70C). The Industrial Grade SX SFP module operates at a wide temperature range (-40C to 85C).

LX SFP modules are supported on the following Extreme Networks devices:
- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- BlackDiamond 10808 switch
- BlackDiamond 12800 series switches
- BlackDiamond 20800 series switches
- Summit X150 series switches
- Summit X250e series switches
- Summit X440 series switches
- Summit X450 series switches
- Summit X450a series switches
- Summit X450e series switches
- Summit X460 series switches
- Summit X480 series switches
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series switches
- E4G series routers (Ethernet ports)

*Optical Budget Calculation*

Measure cable plant losses with a 1310 nm light source and verify this to be within budget.

When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example 0.25 dB/km), Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors, and operating margin. There is no minimum system budget or minimum cable length restriction because the maximum receive power is the same as the maximum transmit power. There is no minimum attenuation or minimum cable length restriction.

For technical specifications for the LX and Industrial Grade LX SFP, see Technical Specifications.

## ZX SFP Module

The ZX SFP module is a long-haul SFP that provides a 1000BASE-X optical connection using LC connectors and SMF cable up to 80 km long.

ZX SFP modules are supported on the following Extreme Networks devices:
- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- BlackDiamond 10808 switch
- BlackDiamond 12800 series switches
- BlackDiamond 20800 series switches
- Summit X150 series switches
- Summit X250e series switches
- Summit X440 series switches
- Summit X450 series switches
- Summit X450a series switches
- Summit X450e series switches
- Summit X460 series switches
- Summit X480 series switches
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series switches
- E4G series routers (Ethernet ports)

### Optical Budget Calculation

Measure cable plant losses with a 1550 nm light source and verify this to be within budget.

When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example, 0.25 dB/km), Extreme Networks recommends that you reserve 3 dB of the total budget for losses induced by cable splices or connectors and operating margin. A minimum system budget or attenuation is required to prevent saturation of the receiver.

For technical specifications for the ZX SFP, see Technical Specifications.

## 1000BASE-BX Bi-Directional SFP Modules

The 1000BASE-BX SFP modules include the 1000BASE-BX-U SFP module and the 1000BASE-BX-D SFP module.

These two SFP modules are used together to permit a bidirectional Gigabit Ethernet connection using a single strand of SMF cable and LC connectors. The 1000BASE-BX-D SFP operates at wavelengths of 1490 nm TX/1310 nm RX, and the 1000BASE-BX-U SFP operates at wavelengths of 1310 nm TX/1490 nm RX. The 1000BASE-BX-U SFP module is always connected to the 1000BASE-BX-D SFP module. The

maximum transmission distance for this connection is 10 km. The 1000BASE-BX SFP modules conform to the IEEE 802.3ah 1000BASE-BX10 standard.

The 1000BASE-BX SFP modules are supported on the following Extreme Networks devices:
- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- BlackDiamond 10808 switch
- BlackDiamond 12800 series switches
- BlackDiamond 20800 series switches
- Summit X150 series switches
- Summit X250e series switches
- Summit X440 series switches
- Summit X450 series switches
- Summit X450a series switches
- Summit X450e series switches
- Summit X460 series switches
- Summit X480 series switches
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- E4G series routers (Ethernet ports)

For technical specifications for the 1000BASE-BX SFP, see Technical Specifications.

## 1100FX SFP Module for Gigabit Ethernet Ports

The 100FX SFP module for Gigabit Ethernet (GE) ports (part number 10063) provides optical links up to 2km long using multimode fiber cable.

The 100FX SFP for GE ports conforms to the 100FX-MMF standard.

The 100FX SFP modules are supported in the following Extreme Networks devices:
- BlackDiamond 8800 series switches
  - G24x I/O module
  - MSM-G8x module
  - G48Xa I/O module
- BlackDiamond 20800 series switches
- Summit X440 series switches
- Summit X450-24x switch: ports 5 through 24 (not supported on combination ports)
- Summit X450a-24x, X450a-24xDC switches: ports 1 through 20 (not supported on combination ports)
- E4G series routers (Ethernet ports; not supported on E4G-400 combination ports)

For technical specifications for the 100FX SFP for Gigabit Ethernet ports, see Technical Specifications.

## Dual-speed 100FX/1000LX SFP Module

The dual-speed 100FX/1000LX SFP module operates at either 100 Mbps or 1000 Mbps over SMF links up to 10 km long.

Operating at 100 Mbps, the dual-speed SFP conforms to the 100BASE-LX standard. Operating at 1000 Mbps, the dual-speed SFP conforms to the 1000BASE-LX standard.

The dual-speed 100FX/1000FX SFP modules are supported in the following Extreme Networks switches:

- BlackDiamond 8800 series switches
- BlackDiamond 12800 series switches
- BlackDiamond 20800 series switches
- Summit X440 series switches
- Summit X450-24x switch: ports 5 through 24 (not supported on combination ports)
- Summit X450a-24x, X450a-24xDC switches: ports 1 through 20 (not supported on combination ports)
- E4G series routers (Ethernet ports)

*Optical Budget Calculation*

The 100FX/1000LX SFP module complies with the 100FX-SMF standard.

To use the 100FX/1000LX SFP module in 100FX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Next, connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

When in SMF operation, 100FX-SMF or 1000LX, measure cable plant losses with a 1310 nm light source and verify this to be within budget. When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example 0.25 dB/km), Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors and operating margin.

### Note

The 100FX/1000LX SFP module detects link status based only on the presence of light in the receive cable. Therefore, if a single strand is broken, the link partner on the other port will not detect link down.

For technical specifications for the 100FX/1000LX SFP, see Technical Specifications.

## LX100 SFP Module

The LX100 SFP module provides a 1000BASE-X optical link up to 100km long using LC connectors and SMF cable.

The LX-100 SFP modules are supported on the following Extreme Networks devices:

- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- BlackDiamond 10808 switch
- BlackDiamond 12800 series switches
- BlackDiamond 20800 series switches
- Summit X150 series switches
- Summit X250e series switches
- Summit X440 series switches
- Summit X450 series switches
- Summit X450a series switches
- Summit X450e series switches
- Summit X460 series switches
- Summit X480 series switches
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series switches
- E4G series routers (Ethernet ports)

For technical specifications for the LX100 SFP, see Technical Specifications.

## 100BASE-LX10 SFP Module

The 100BASE-LX10 SFP module provides a 100-Mbps optical connection using LC connectors and SMF cable.

The maximum transmission distance for this connection is 10 km.

The LX10 SFP module is supported in the following Extreme Networks devices:
- Summit X250e series switches: all ports
- Summit X150 series switches: combination ports only
- Summit X460 series switches
- Summit X440 series switches
- Summit X480 series switches
- E4G series routers (Ethernet ports)

For technical specifications for the 100BASE-LX10 SFP, see Technical Specifications.

## 100BASE-BX Bi-Directional SFP Modules

The 100BASE-BX SFP modules include the 100BASE-BX-U SFP module and the 100BASE-BX-D SFP module.

These two SFP modules are used together in a Summit family switch to permit a bidirectional 100-Mbps Ethernet connection using a single strand of SMF cable and LC connectors. The 100BASE-BX-U SFP module is always connected to the 100BASE-BX-D SFP module. The 100BASE-BX-D SFP operates at wavelengths of 1550-nm TX/1310-nm RX wavelength), and the 1000BASE-BX-U SFP operates at

wavelengths of 1310 nm TX/1550 nm RX. The maximum transmission distance for this connection is 10 km. The 100BASE-BX SFP modules conform to the IEEE 802.3ah standard.

The 100BASE-BX SFP modules are supported in the following Extreme Networks devices:

- Summit X250e series switches: all ports
- Summit X150 series switches: combination ports only
- Summit X440 series switches
- E4G series routers (Ethernet ports)

For technical specifications for the 100BASE-BX bi-directional SFP, see Technical Specifications.

## 100FX SFP Module for Fast Ethernet Ports

The 100FX SFP module for fast Ethernet (FE) ports (part number 10067) provides a 100-Mbps optical link using LC connectors and 1310-nm multimode fiber (MMF) cable.

The maximum transmission distance for this connection is 2 km.

The 100FX SFP module for FE ports is supported in the following Extreme Networks devices:

- Summit X250e series switches: all ports
- Summit X150 series switches: combination ports only
- Summit X440 series switches
- E4G series routers (Ethernet ports)

For technical specifications for the 100FX SFP module for fast Ethernet ports, see Technical Specifications.

## SR SFP+ Module

The SR SFP+ module provides a 10-Gbps optical connection using LC connectors and multimode fiber cable up to 300 meters long.

The SR SFP+ module conforms to the 10GBASE-SR standard.

The SR SFP+ module is supported in the following Extreme Networks switches and modules:

- BlackDiamond X8 switch
- Summit X650-24x switch
- VIM1-10G8X versatile interface module for the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670 series switches
- E4G series routers (Ethernet ports)

For technical specifications for the SR SFP+, see Technical Specifications.

## LR SFP+ Module

The LR SFP+ module provides a 10-Gbps optical connection using LC connectors and single-mode fiber cable up to 10 kilometers long.

The LR SFP+ module conforms to the 10GBASE-LR standard.

The LR SFP+ module is supported in the following Extreme Networks switches:
- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- Summit X650-24x switch (ports 1 through 24 on the front panel)
- VIM1-10G8X versatile interface module for the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670 series switches
- E4G series routers (Ethernet ports)

For technical specifications for the LR SFP+, see Technical Specifications.

## ER SFP+ Module

The ER SFP+ module provides a 10-Gbps optical connection using LC connectors and single-mode fiber cable up to 40 kilometers long.

The ER SFP+ module conforms to the 10GBASE-ER standard.

The ER SFP + module is supported in the following Extreme Networks switches:
- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- Summit X650-24x switch (ports 1 through 24 on the front panel)
- VIM1-10G8X versatile interface module in the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670 series switches
- E4G series routers (Ethernet ports)

For technical specifications for the ER SFP+, see Technical Specifications.

## LRM SFP+ Module

The LRM SFP+ module provides a 10-Gbps optical connection using LC connectors and multimode fiber cable up to 220 meters long. The LRM SFP+ module conforms to the 10GBASE-LRM standard.

The LRM SFP+ module supports link lengths of 220 meters on legacy multimode fiber (MMF) cable. To ensure that specifications are met over Fiber Distributed Digital Interface (FDDI) grade OM1 and OM2 fibers, the transmitter should be coupled through a mode conditioning patch cord. No mode conditioning patch cord is required for applications over OM3 fiber.

The LRM SFP+ is supported in the following Extreme Networks switches:

- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- Summit X650-24x switch (ports 1 through 24 on the front panel)
- VIM1-10G8X versatile interface module in the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670V-48x switch
- E4G series routers (Ethernet ports)

For technical specifications for the LRM SFP+, see Technical Specifications.

## ZR SFP+ Module

ZR SFP+ Module The ZR SFP+ module is a long-haul SFP+ module that provides a 10GBASE-X optical connection using LC connectors and SMF cable up to 80 km long.

ZR SFP+ modules are supported on the following Extreme Networks devices:

- BlackDiamond 8800 series switches
- BlackDiamond X8 switch
- Summit X650-24x switch (ports 1 through 24 on the front panel)
- VIM1-10G8X versatile interface module in the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670V-48x switch
- E4G series routers (Ethernet ports)

**Caution**

In cases where there are more than six available ports, only 50% of the available ports on the switch should be populated when using the SFP+ ZR optic. Populate the ports so that there is one empty port for every two vertical ports to evenly distribute the occupied ports.

**Warning**

To prevent permanent damage to the ZR SFP+ and other equipment: always check the optical input power of the receiver before inserting the fiber. The maximum optical input power for the receiver is -7 dBm. If you use optical loopback for diagnostics purposes, the loopback requires a minimum of 15 dB optical attenuation. The recommended attenuation range is 15 dB to 20dB.

For optical budget calculation measure cable plant losses with a 1550 nm light source and verify this to be within budget. When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example, 0.25 dB/km), Extreme Networks recommends that you reserve 3 dB of the total budget for losses induced by cable splices or connectors and operating margin. A minimum system budget or attenuation is required to prevent saturation of the receiver.

For technical specifications for the ZR SFP+, see Technical Specifications.

## 10/100/1000BASE-T Copper SFP and Industrial Grade SFP Module

The Extreme Networks 10/100/1000BASE-T copper SFP module is compatible with the Gigabit Ethernet standard and 1000 Base-T standard as specified in the IEEE 802.3ab standard. This SFP module provides a 100-Mbps connection using Category 5 cable.

The 10/100/1000BASE-T copper SFP module operates at a commercial temperature range (0C to 70C). The Industrial Grade 10/100/1000BASE-T copper SFP module operates at a wide temperature range (-40C to 85C).

### Note
If the 10/100/1000BASE-T copper SFP GBIC is plugged into a 10G SFP+ port, the GBIC will function only at 1G speeds.

10/100/1000BASE-T SFP module is supported in the following Extreme Networks devices:

- BlackDiamond 8800 series switches
- Black Diamond X8 series switches
- Summit X440 series switches (not supported on combination ports)
- Summit X450 series switches (not supported on combination ports)
- Summit X450a series switches (not supported on combination ports)
- Summit X450e series switches (not supported on combination ports)
- Summit X460 series switches (not supported on combination ports)
- Summit X650 series switches
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X650-24t switch: VIM1 module ports
- Summit X670-48x and X670V-48x switches
- E4G series routers (Ethernet ports; not supported on E4G-400 combination ports)

For technical specifications for the ZR SFP+, see Technical Specifications.

## Prepare to Install or Replace an SFP Module

Complete the following tasks before inserting the SFP module:

1 Inspect and clean the fiber tips, coupler, and connectors.
2 Prepare and clean an external attenuator, if needed.
3 When handling fiber cables, take the following precautions to prevent damage to the cables:
   a Do not stretch the fiber.
   b Make sure the bend radius of the fiber is not less than 2 inches (5.08 cm).
4 Extreme Networks recommends the following guidelines when installing or replacing SFP modules on an active network:
   a Use the same type of SFP module at each end of the link, except for the 1000BASE-BX and 100BSE-BX bi-directional SFP modules. The bi-directional SFP modules include a D-type and a U-type. You must use one D-type SFP and one U-type SFP together to allow for a single fiber bidirectional connection.
   b Connect one end of the link to the Tx port. Without an attenuator, measure the total loss from the Tx port to the other site of the link. The total loss must not exceed the total optical system budget.

## Install an SFP Module

You can add or remove SFP modules in your switch without powering off the system.

Optical SFP Module Types and Connectors and Copper SFP Module show the types of SFP modules and connectors.

> **Note**
>
> The bi-directional SFP modules combine two SFP optical devices that must be used as a pair to establish the bidirectional connection over a single fiber. Module C and Module D in Optical SFP Module Types and Connectors show the pair of SFPs for a bi-directional SFP module.

**Warning**

Optical SFPs contain Class 1 lasers. Invisible laser radiation can occur when laser connections areunplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10 and EN60825-1A2:2001.
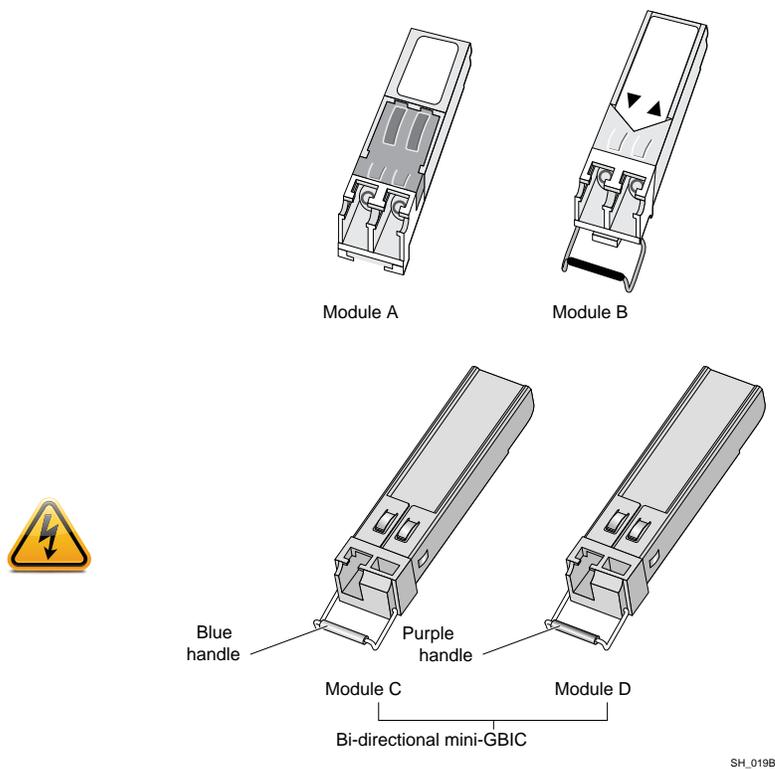


**Figure 1: Optical SFP Module Types and Connectors**
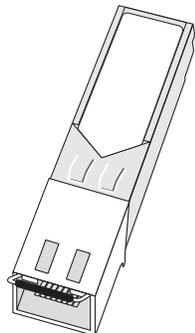


**Figure 2: Copper SFP Module**

**Caution**

1   Holding the SFP module by its sides, insert the SFP module into the port on the switch.
2   Slide the SFP module into the port until you hear it click.

If the SFP module has a handle, push up on the handle to secure the SFP module.

> **Note**
> Disconnect fiber-optic cable from an optical SFP module before removing the SFP module from the port.

## Connecting Fiber Cables

Before you connect fiber cables to the dual-speed 100FX/1000LX SFP module or the LX100 SFP module, note the following information about these SFP modules

### 100FX/1000LX SFP Module

The 100FX/1000LX SFP module complies with the 100FX-SMF standard.

In order to use the 100FX/1000LX SFP module in 100FX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Then connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

### LX100 SFP Module

To prevent permanent damage to the LX100 SFP module, always check the optical input power of the receiver before you insert the fiber cable.

The maximum optical input power is -9 dBm. If you use an optical loopback for diagnostics, the loopback requires a minimum of 12 dB optical attenuation. The recommended attenuation range is 12 to 20 dB.

## Remove an SFP Module

1   Disconnect the optical cable from the SFP module.
2   Unlatch the SFP module in one of the following ways:
    a   On an SFP module similar to Module A in Optical SFP Module Types and Connectors, press and hold the black plastic tab at the bottom of the connector.
    b   On an SFP module similar to Module B, Module C, or Module D in Optical SFP Module Types and Connectors, rotate the front handle down.
3   Pull the SFP module out of the port on the switch.

# 3 QSFP+ Modules

## QSFP+ Modules

A QSFP+ module provides four 10-gigabit transmit and receive channels in a single pluggable optical module, for an aggregate bandwidth of 40 Gbps. QSFP+ modules are used in Extreme Networks BlackDiamond and Summit switches.
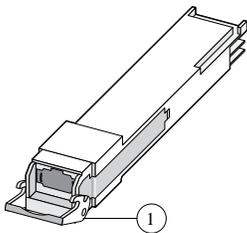


**Figure 3: QSFP+ Optical Module (Release Handle)**

You can insert or remove QSFP+ modules without powering down the system.

The information in this guide about hardware platform support for QSFP+ modules is current as of the date this guide was published. Support for QSFP+ modules may have been added to other switches or I/O modules besides those listed in this guide. For current information about hardware support and the minimum required software for QSFP+ modules, refer to the most recent version of the ExtremeXOS Hardware and Software Compatibility Matrix.

## SR4 QSFP+ Module

The SR4 QSFP+ R4 module provides a 40-Gbps optical connection using MTP® (MPO) optical connectors.

This optical module integrates four data lanes in each direction with 40 Gbps aggregatebandwidth. Each lane can operate at 10.3125 Gbps up to 100 meters using OM3 fiber or upto150meters using OM4 fiber. The SR4 QSFP+ module conforms to the 802.3ba D3.2 (40GBASE-SR4)standard.

The SR4 QSFP+ module is supported in the following Extreme Networks switches and components:

- BlackDiamond X8 switch
- BlackDiamond 8900-40G6X-xm I/O module
- SummitStack-V80 stacking module installed in a Summit X460 series switch
- VIM2-SummitStack-V80 module installed in a Summit X480 series switch
- VIM3-40G module installed in a Summit X650 series switch
- VIM4-40GX module installed in a Summit X670V-48x switch

For technical specifications for the QSFP+ module, see Technical Specifications.

## LR4 QSFP+ Module

The LR4 QSFP+ module provides a 40-Gbps optical connection using LC optical connectors. This optical module integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10.3125 Gbps up to 10Km using single mode fiber. The LR4 QSFP+ module conforms to the 802.3ba (40GBASE-LR4) standard.

The LR4 QSFP+ module is supported in the following Extreme Networks switches and components:
- BlackDiamond X8 switch
- BlackDiamond 8900-40G6X-xm I/O module
- SummitStack-V80 stacking module installed in a Summit X460 series switch
- VIM2-SummitStack-V80 module installed in a Summit X480 series switch
- VIM3-40G module installed in a Summit X650 series switch
- VIM4-40GX module installed in a Summit X670V-48x switch

For technical specifications for the QSFP+ module, see Technical Specifications.

## Install a QSFP+ Module

You can install or remove QSFP+ modules in your switch without powering off the system.

### Warning

QSFP+ modules contain Class 1M lasers. Invisible laser radiation can occur when laser connections areunplugged. Do not stare into the beam. This device is compliant with IEC 60825-1 Amendment 2 and CFR21Section 1040.

1  Remove the QSFP+ module from its antistatic container and remove the dust covers from the module optical connector.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2  Remove any rubber dust covers from the port where you are installing the QSFP+ module.

3  Holding the QSFP+ module by its sides, insert the QSFP+ module into the port on the switch or module.
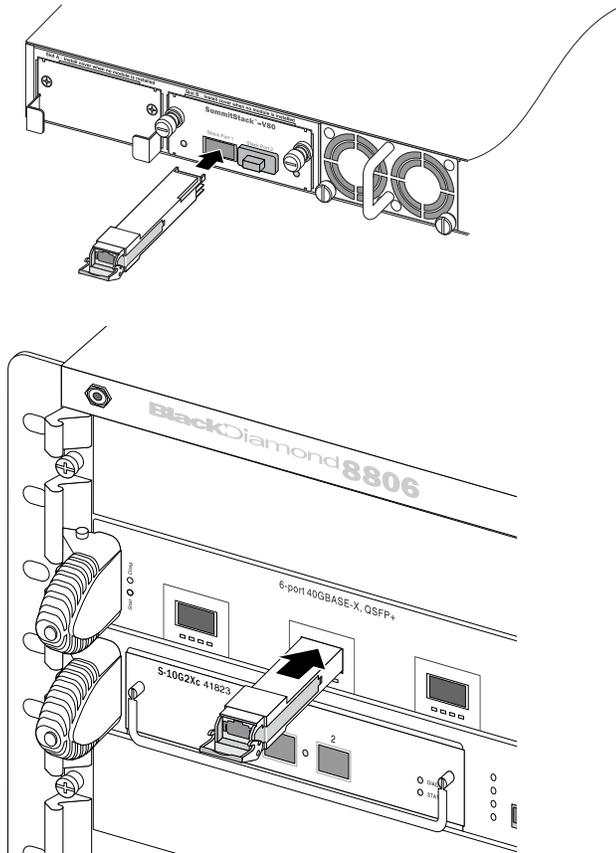
**Figure 4: Installing a QSFP+ Module (Summit family switch and BlackDiamond 8800 series switch)**

4   Slide the QSFP+ module into the port until you hear it click into place (Installing a QSFP+ Module (Summit family switch and BlackDiamond 8800 series switch) and Installed QSFP+ Module (Summit family switch and BlackDiamond 8800 series switch)).

5   Push up on the handle to secure the QSFP+ module in the switch.
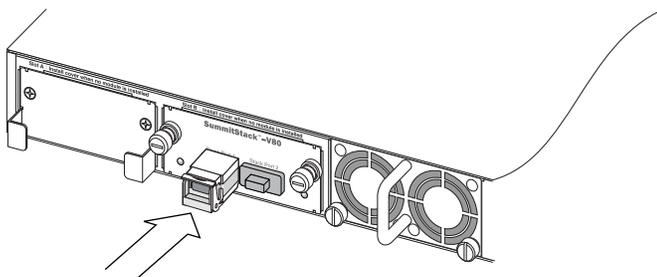


**Figure 5: Installed QSFP+ Module (Summit family switch and BlackDiamond 8800 series switch)**

If you are installing only one QSFP+ module, make sure that all unoccupied ports are covered with a rubber dust cover, which is shipped with the Summit option card or BlackDiamond I/O module (Installed QSFP+ Module (Summit family switch and BlackDiamond 8800 series switch)).

# Remove a QSFP+ Module

You can remove a QSFP+ module from your Extreme Networks switch without powering off the system.

> **Note**
>
> Disconnect fiber-optic cable from a QSFP+ module before removing the QSFP+ module from the port.

1  Rotate the handle (bail latch) on the QSFP+ module downward.
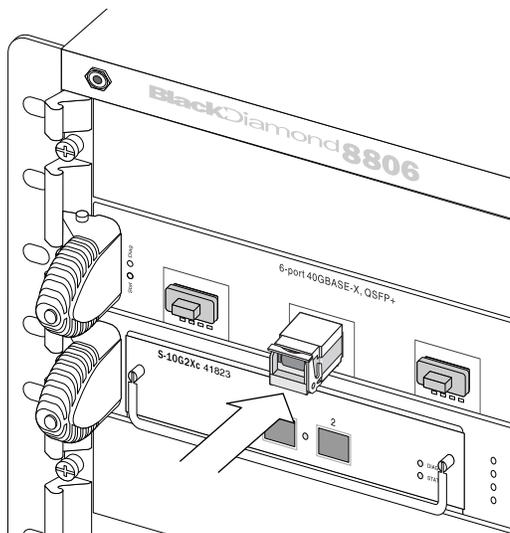


**Figure 6: Removing a QSFP+ Module**

2  Pull the connector out of the port.

# 4 Direct-Attach Cables

Types of Direct-Attach Cables
SFP+ Direct-Attach Passive Cable
QSFP+ Direct-Attach Cables

Direct-attach copper and fiber cables provide connections between unpopulated SFP+ and QSFP+ ports.

This section describes direct-attach cables that are used with Extreme Networks optical modules and includes the following sections:

Regulatory compliance information for all cables is listed in Technical Specifications.

## Types of Direct-Attach Cables

Extreme Networks switches support three types of direct-attach cables that connect to SFP+ or QSFP +modules:

- SFP+ direct-attach passive cable
- QSFP+ direct-attach passive copper cable
- QSFP+ direct-attach active fiber cable

The type of device and compatible optical module determine the compatible type of direct-attach cable.

Use only Extreme Networks-certified cables, available from Extreme Networks, to make connections to the SFP+ or QSFP+ port on the switch or I/O module.

You can connect or disconnect direct-attach cables without powering down the system.

## SFP+ Direct-Attach Passive Cable

The SFP+ direct-attach passive cable provides a 10-Gbps copper connection between unpopulated SFP+ ports

The cable is available in lengths from 1 meter to 10 meters and is terminated in connectors that are inserted directly into the SFP+ cages in place of optical SFP+ modules.
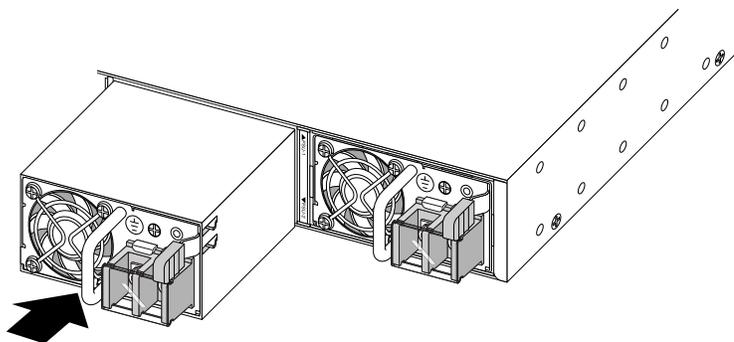
SH_107

**Figure 7: Types of SFP+ Direct-Attach Cable (Type A and Type B)**
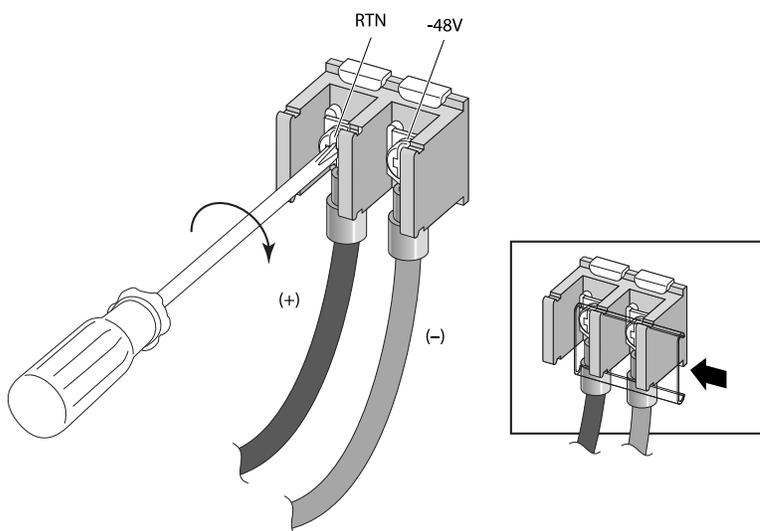


SFP+ Direct-Attach Cables lists the available SFP+ direct-attach cables and their model numbers.

**Table 3: SFP+ Direct-Attach Cables**

| Model Number | Length | Model Number | Length |
|---|---|---|---|
| 10304 | 1 meter | 10306 | 5 meters |
| 10305 | 3 meters | 10307 | 10 meters |

The SFP+ direct-attach cable is compatible with the following Summit devices and components:

- BlackDiamond X8 switch
- S-10G2Xc card in a BlackDiamond 8000 series MSM
- XGM2-2sf option card in a Summit X350, X450a, or X450e series switch
- XGM3-2sf option card in a Summit X460 series switch
- Summit X650-24x switch (front ports)
- VIM1-G8X versatile interface module in a Summit X650 series switch
- Summit X670-48x series switches (front ports)
- E4G series routers (XGM3S-2sf or XGM3SB-4sf option card required)

## Connect an SFP+ Direct-Attach Cable

To connect an SFP+ direct-attach cable:

1   Holding the SFP+ connector by its sides, insert the connector into the port on the switch (Connecting an SFP+ Direct-Attach Cable to a Front-Panel Port (Cable A and Cable B) and Connecting an SFP+ Direct-Attach Cable to an XGM2-2sf Option Card (Cable A and Cable B)).
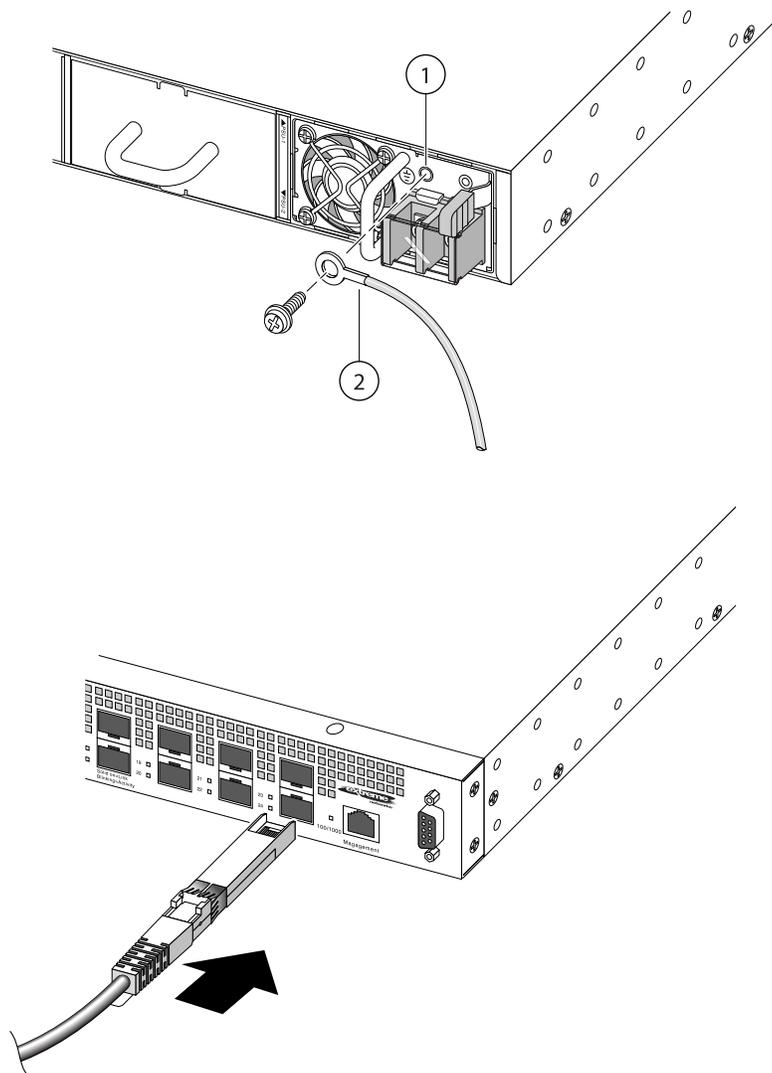
**Figure 8: Connecting an SFP+ Direct-Attach Cable to a Front-Panel Port (Cable A and Cable B)**
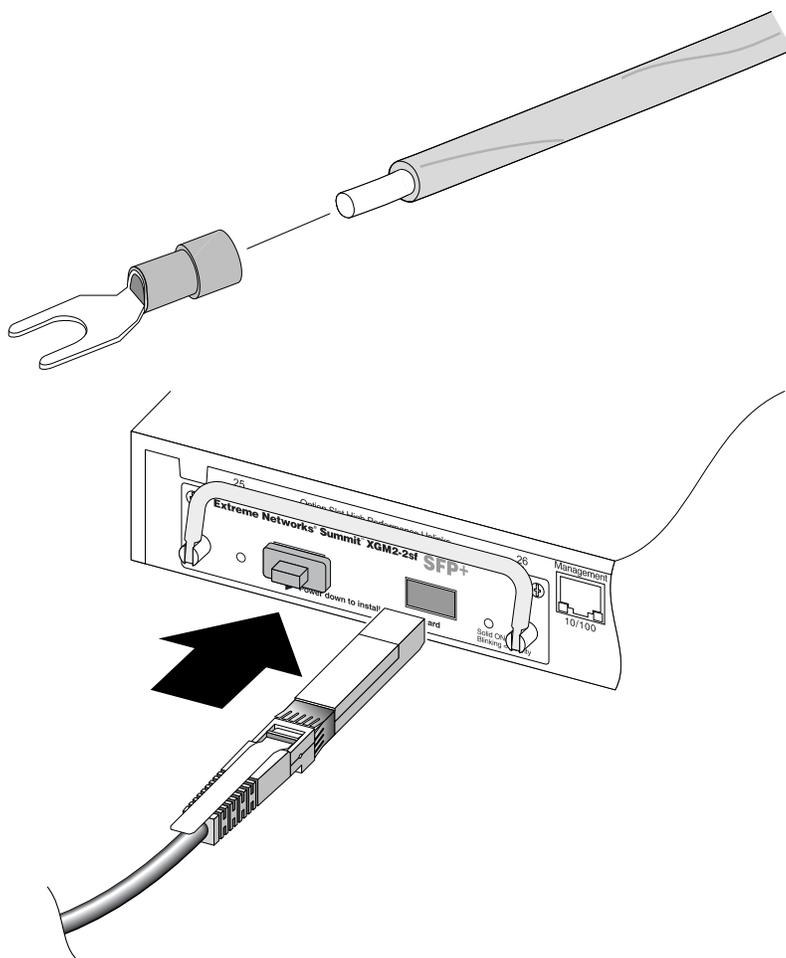
**Figure 9: Connecting an SFP+ Direct-Attach Cable to an XGM2-2sf Option Card (Cable A and Cable B)**

2   Slide the connector into the port until you hear it click into place.

## Disconnect an SFP+ Direct-Attach Cable

1   If the cable connector is similar to cable A in Types of SFP+ Direct-Attach Cable (Type A and Type B), push the release latch toward the port on the switch.
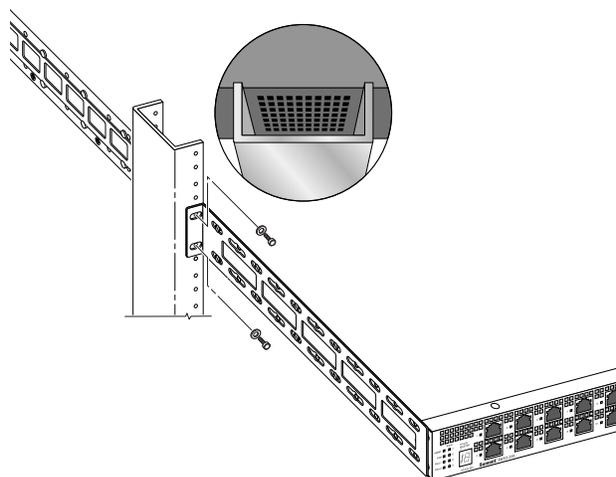
**Figure 10: Disconnecting an SFP+ Direct-Attach Cable (Cable A)**

If the connector is similar to cable B in Types of SFP+ Direct-Attach Cable (Type A and Type B), pull the tab away from the switch port.
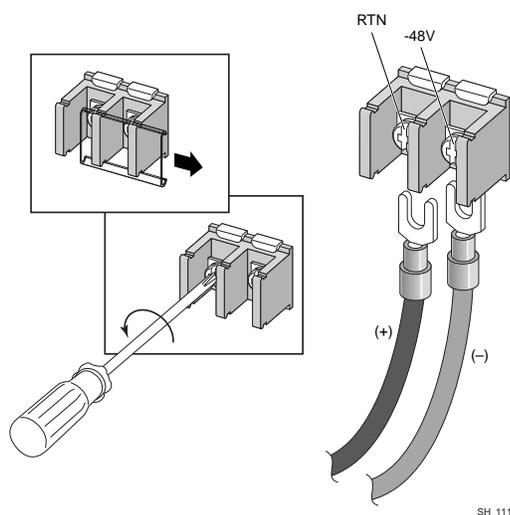


**Figure 11: Disconnecting an SFP+ Direct-Attach Cable (Cable B)**

2   Pull the connector out of the port.

## QSFP+ Direct-Attach Cables

The QSFP+ direct-attach cables are available to provide the following types of connections:

- Single-connection cables provide a 40-Gbps (4 x 10-Gbps) bidirectional copper or optical connection between unpopulated QSFP+ ports.
- Fan-out cables provide four 10-Gbps bidirectional copper connections to a single QSFP+port.

These cables are available in lengths from 0.5meter to 100 meters and are terminated in connectors that are inserted directly into the QSFP+ or SFP+ cages in place of optical modules.

The following table lists the available QSFP+ direct-attach cables and their model numbers.

**Table 4: QSFP+ Direct-Attach Cables**

| Cable Description | Model Number | Length |
| --- | --- | --- |
| QSFP+ passive copper cable | 10311 | 0.5 meter |
| | 10312 | 1 meter |
| | 10313 | 3 meters |
| | 10313A | 3 meters (26 AWG) |
| | 10323 | 5 meter |
| QSFP+ active optical cable | 10315 | 10 meters |
| | 10316 | 20 meters |
| | 10318 | 100 meters |
| QSFP+ fan-out passive copper cable | 10202 | 1 meter |
| | 10203 | 2 meters |
| | 10321 | 3 meters |
| | 10322 | 5 meters |

The QSFP+ direct-attach cables are compatible with the following Extreme Networks switches and components:

- BlackDiamond X8 switch
- SummitStack-V80 stacking module in a Summit X460 series switch
- VIM2-SummitStack-V80 module in a Summit X480 series switch
- BlackDiamond 8900-40G6X-xm I/O module
- VIM3-40G4X module installed in a Summit X480 or X650 series switch
- VIM4-40G4X module installed in a Summit X670V series switch

## Connect a QSFP+ Direct-Attach Cable

1 Holding the QSFP+ connector by its sides, insert the connector into the port on the switch (Installing a QSFP+ Module (Summit family switch and BlackDiamond 8800 series switch)).
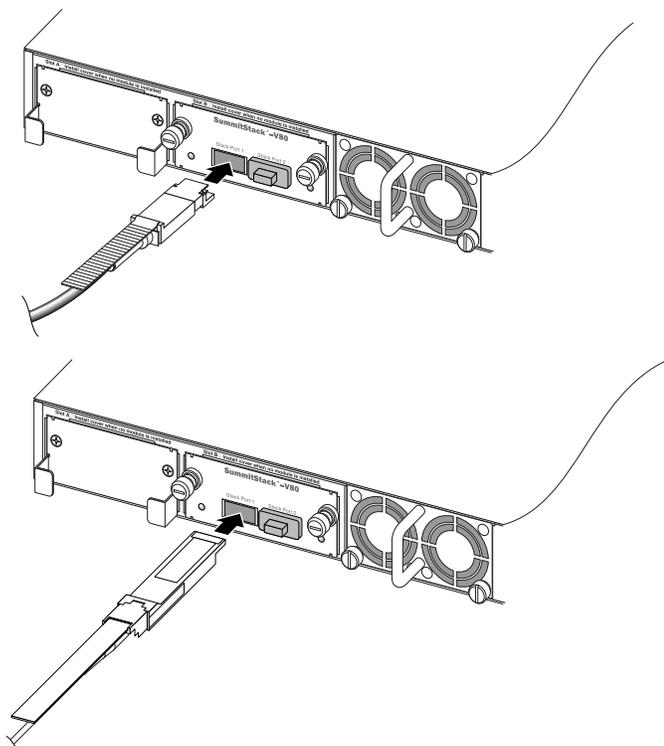
**Figure 12: Connecting a QSFP+ Direct-Attach Cable to a SummitStack-V80 Module (Passive Copper Cable and Active Optical Cable)**

2 Push the connector into the port until you hear it click into place.

## Disconnect a QSFP+ Direct-Attach Cable

1 Hold the connector firmly as you pull the release tab away from the stacking port (Removing a QSFP+ Module).
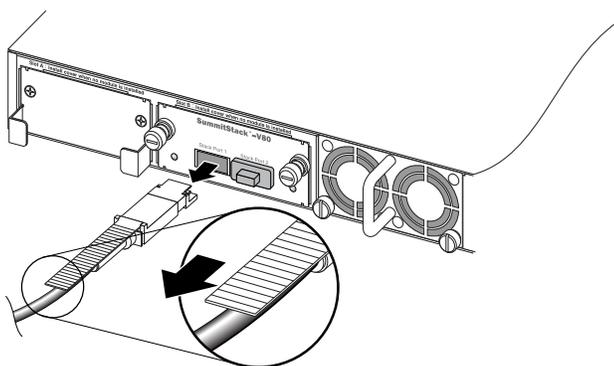


**Figure 13: Disconnecting a QSFP+ Direct-Attach Cable (Passive Copper Cable and Active Optical Cable)**

2 Pull the connector out of the port.

# 5 Extreme Networks XFP Modules

**Overview of XFP Modules**
**Install an XFP Module**
**Remove an XFP Module**

## Overview of XFP Modules

XFP modules are 10-gigabit modules that convert serial electrical signals to external serial optical or electrical signals. They are used in the following Extreme Networks devices:

* Summit X350, X450a, X450e, X460, and X480 series switches
* BlackDiamond 10G4Xa, 10G4Xc, and 10G8Xc I/O modules for the BlackDiamond 8800 series switches
* BlackDiamond GM-40XA, GM-40XB, and HM-2X24GA I/O modules for the BlackDiamond 20800 series switch
* E4G-400 Cell Site Aggregation Routers (XGM3S-2xf module required)
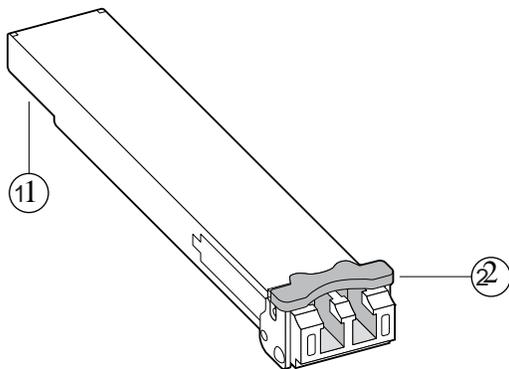


**Figure 14: XFP Module**

**Table 5: XFP Module components**

| 1 = Card edge connector | 2 = Handle |
| --- | --- |

XFP modules can be installed or replaced in an Extreme Networks switch, I/O module, or router without powering off the system. All Extreme Networks XFP modules comply with IEEE 802.3ae standards and with the latest XFP multi-source agreement (MSA).

Extreme Networks switches and modules support the following types of XFP modules:

* LR XFP module

The LR XFP module uses single-mode fiber (SMF) cable for links up to 10 km long. It has an LC duplex connector.

- SR XFP module

  The SR XFP module uses multimode fiber (MMF) cable for links up to 300 m long. It has an LC duplex connector.

- ER XFP module

  The ER XFP module uses SMF cable for links up to 40 km long. It has an LC duplex connector.

- ZR XFP modules

  The ZR XFP module uses SMF cable for links up to 80 km long. It has an LC duplex connector.

- Tunable DWDM XFP modules

  The tunable DWDM XFP module uses SMF cable for links up to 80 km long. It has an LC duplex connector.

For current information about hardware support for XFPs, refer to the most recent version of the ExtremeXOS Hardware and Software Compatibility Matrix.

Technical specifications for XFP modules are listed in Technical Specifications.

# Install an XFP Module

This section describes how to install an XFP module. You can install or remove an XFP module in your Extreme Networks switch without powering off the system.

**Warning**

XFP modules contain Class 1 lasers. Invisible laser radiation can occur when laser connections areunplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10 and EN60825-1A2:2001.

**Caution**

To prevent ESD damage to the XFP module, always use an appropriately grounded ESD-preventive wrist strap when installing or removing the module. Handle the module by its sides only. Never touch the card-edge connectors at the insertion end of the module.

1 Remove the X FP module from its antistatic container and remove the dust covers from the module optical connectors.

  If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2   Remove any rubber dust covers from the port where you are installing the XFP module.

On a Summit option card, move the handle to an upright position to access the XFP ports (see Accessing the XFP Ports).
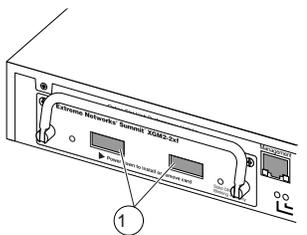


**Figure 15: Accessing the XFP Ports**

3   Make sure that the XFP handle (bail latch) is rotated all the way up (see Installing an XFP Module (Summit family switch and BlackDiamond 8800 series switch)).

4   Holding the module by its sides, partially insert the XFP module into the XFP port (see Installing an XFP Module (Summit family switch and BlackDiamond 8800 series switch)).
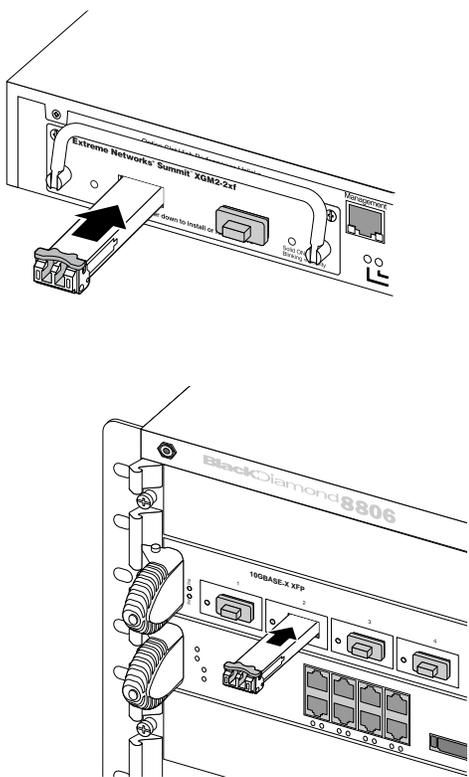


**Figure 16: Installing an XFP Module (Summit family switch and BlackDiamond 8800 series switch)**

5   Slide the XFP module as far as possible into the slot until you hear it click, indicating that it is firmly attached (see Installing an XFP Module (Summit family switch and BlackDiamond 8800 series switch) and Installed XFP Module (Summit family switch and BlackDiamond 8800 series switch)).
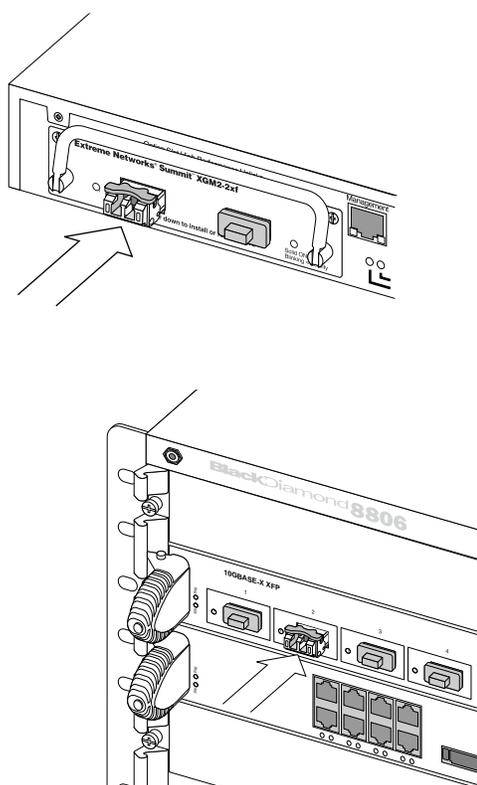
**Figure 17: Installed XFP Module (Summit family switch and BlackDiamond 8800 series switch)**

6  If you are installing only one XFP module, make sure that all unoccupied ports are covered with rubber dust covers, which are shipped with the option card or I/O module (see Installed XFP Module (Summit family switch and BlackDiamond 8800 series switch)).

---

Note

To prevent permanent damage to a ZR XFP or DWDM XFP, always check the optical input power of the receiver before inserting the fiber cable. The maximum optical input power for these XFPs is –7 dBm. If you use an optical loopback for diagnostics, the loopback requires a minimum of 15 dB optical attenuation. The recommended attenuation range is 15 to 20 dB.

To ensure that your XFP module is undamaged upon installation, you can correlate factory test data with your installation site test data by consulting the average power reference values shown on the XFP module test data sheet (Part No. 121080-00) enclosed with the module.

---

# Remove an XFP Module

You can remove an XFP module from your Extreme Networks switch or I/O module without powering off the system. The XFP module is shown in XFP Module..

> **Note**
> Disconnect fiber-optic cable from an XFP module before removing the XFP module from the port.

1  Rotate the handle (bail latch) on the XFP module downward (Removing an XFP Module).
2  Carefully pull the XFP module out of the port.
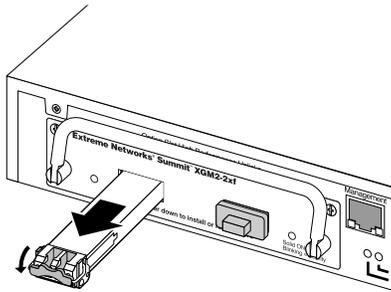


**Figure 18: Removing an XFP Module**

3  Place the dust covers back into the XFP module connectors.
4  Place the XFP module immediately into an antistatic container to protect it from ESD damage and dust.

# 6 Extreme Networks XENPAK Transceivers

## Overview of XENPAK Modules

The BlackDiamond 8800 series switches, BlackDiamond 10808 switch, BlackDiamond 12800 series switches, and Summit family switches support several types of XENPAK transceiver modules. All of these modules conform to the 10Gigabit Ethernet standard defined by the IEEE 802.3ae as applicable

> **Caution**
>
> XENPAK modules contain Class 1 laser devices. Invisible laser radiation can occur when the connectorsare open. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10, 1040.11,andEN60825-1A2:2001.

Extreme Networks switches and modules support the following types of XENPAK interfaces:

- SR XENPAK
- LR XENPAK
- ER XENPAK
- ZR XENPAK
- LX4 XENPAK
- LW XENPAK

> **Note**
>
> CX4 XENPAKs are also supported by Extreme Networks devices; contact your vendor to obtain these.
>
> Use only Extreme Networks-approved XENPAK modules in all Extreme Networks devices.

## SR XENPAK

The SR XENPAK supports multimode fiber (MMF) cable and has SC connectors. The SR XENPAK requires the software versions listed here.

**Table 6: BlackDiamond Switches**

| Switch Model | Required Software |
|---|---|
| BlackDiamond 10808 | ExtremeXOS 11.1.1 or later |
| BlackDiamond 8800 series | ExtremeXOS 11.1.1 or later |
| BlackDiamond 12804 | ExtremeXOS 11.4 or later |
| BlackDiamond 12802 | ExtremeXOS 12.0 or later |

**Table 7: Summit Switches**

| Switch Model | Required Software |
|---|---|
| Summit X450 series | ExtremeXOS 11.2.0 or later |
| Summit X450a series | ExtremeXOS 11.2.0 or later |
| Summit X450e series | ExtremeXOS 11.2.0 or later |

For technical specifications for the SR XENPAK, see Technical Specifications.

## LR XENPAK

The LR XENPAK supports single-mode fiber (SMF) cable and has SC connectors. The LR XENPAK requires the software versions listed here.

**Table 8: BlackDiamond Switches**

| Switch Model | Required Software |
|---|---|
| BlackDiamond 10808 | ExtremeXOS 11.1.1 or later |
| BlackDiamond 8800 series | ExtremeXOS 11.1.1 or later |
| BlackDiamond 12804 | ExtremeXOS 11.4 or later |
| BlackDiamond 12802 | ExtremeXOS 12.0 or later |

**Table 9: Summit Switches**

| Switch Model | Required Software |
|---|---|
| Summit X450 series | ExtremeXOS 11.2.0 or later |
| Summit X450a series | ExtremeXOS 11.2.0 or later |
| Summit X450e series | ExtremeXOS 11.2.0 or later |

For technical specifications for the LR XENPAK, see Technical Specifications

## ER XENPAK

The ER XENPAK supports SMF cable and has SC connectors. The ER XENPAK requires the software versions listed here.

**Table 10: BlackDiamond Switches**

| Switch Model | Required Software |
|---|---|
| BlackDiamond 10808 | ExtremeXOS 11.1.1 or later |
| BlackDiamond 8800 series | ExtremeXOS 11.1.1 or later |
| BlackDiamond 12804 | ExtremeXOS 11.4 or later |
| BlackDiamond 12802 | ExtremeXOS 12.0 or later |

**Table 11: Summit Switches**

| Switch Model | Required Software |
|---|---|
| Summit X450 series | ExtremeXOS 11.2.0 or later |
| Summit X450a series | ExtremeXOS 11.2.0 or later |
| Summit X450e series | ExtremeXOS 11.2.0 or later |

For technical specifications for the ER XENPAK, see Technical Specifications.

# ZR XENPAK

The ZR XENPAK supports SMF cable and has SC connectors. The ZR XENPAK requires the software versions listed here.

**Table 12: BlackDiamond Switches**

| Switch Model | Required Software |
|---|---|
| BlackDiamond 10808 | ExtremeXOS 11.3.1 or later |
| BlackDiamond 8800 series | ExtremeXOS 11.3.1 or later |
| BlackDiamond 12804 | ExtremeXOS 11.4 or later |
| BlackDiamond 12802 | ExtremeXOS 12.0 or later |

**Table 13: Summit Switches**

| Switch Model | Required Software |
|---|---|
| Summit X450 series | ExtremeXOS 11.3.1 or later |
| Summit X450a series | ExtremeXOS 11.3.1 or later |
| Summit X450e series | ExtremeXOS 11.3.1 or later |

For technical specifications for the ZR XENPAK, see Technical Specifications.

**Warning**

To prevent permanent damage to the ZR XENPAK and other equipment: always check the optical input power of the receiver before inserting the fiber. The maximum optical input power for the receiver is -7 dBm. If you use optical loopback for diagnostics purposes, the loopback requires a minimum of 15 dB optical attenuation. Therecommended attenuation range is 15 dB to 20dB.

## LW XENPAK

The LW XENPAK module requires the software versions listed here.

**Table 14: BlackDiamond Switches**

| Switch Model | Required Software Release |
| --- | --- |
| BlackDiamond 10808 | ExtremeXOS 11.4.1 or later |
| BlackDiamond 12804 | ExtremeXOS 11.4.1 or later |
| BlackDiamond 12802 | ExtremeXOS 12.0 or later |

**Table 15: Summit Switches**

| Switch Model | Required Software Release |
| --- | --- |
| Summit X450a | ExtremeXOS 11.5.0 or later |
| Summit X450e | ExtremeXOS 11.5.0 or later |

**Note**

BlackDiamond 10808 switches and BlackDiamond 12804 switches running software earlier than ExtremeXOS 11.4.2.3 do not support jumbo-size frame for the LW XENPAK. These switches support only standard-size frame for the LW XENPAK.

BlackDiamond 10808 switches and BlackDiamond 12804 switches running the latest version of ExtremeXOS 11.4 support jumbo-size frame for the LW XENPAK with a 5% decrease in performance, allowing for 95% of the maximum WAN PHY traffic.

ExtremeXOS 11.5.0 or later supports the LW XENPAK at full functionality with 100% performance in the Summit X450a and X450e series switches.

**Caution**

The maximum input power (average receive power) should be less than 0.5 dBm.

For technical specifications for the LW XENPAK, see Technical Specifications.

### Transmitter Clock Locking Mode

The LW XENPAK module provides an interface connection between a 10-gigabit Ethernet and a 10-gigabit SONET/SDH network from a 10-gigabit Ethernet equipment port.

The default transmitter clock locking mode of the LW XENPAK module is set to line timing mode. When in line timing mode, the LW XENPAK module transmitter clock is locked to the receiver-recovered clock. When the LW XENPAK is connected to the SONET/SDH network on the other side of optical cable, the LW XENPAK transmitter clock synchronizes with the SONET/SDH clock source, which helps reduce the pointer adjustment between the SONET/SDH network and the LW XENPAK.

To prevent a clock reference loop, be sure that only one end of a link is using line timing mode and to use internal timing when testing with an optical loopback cable.

## LX4 XENPAK

The LX4 XENPAK supports multimode MMF cable in intra-building connections and SMF cable for interbuilding connections.

The LX4 XENPAK has SC connectors.

The LX4 XENPAK requires the software versions listed here.

**Table 16: BlackDiamond Switches**

| Switch Model | Required Software |
|---|---|
| BlackDiamond 10808 | ExtremeXOS 11.3.1 or later |
| BlackDiamond 8800 series | ExtremeXOS 11.3.1 or later |
| BlackDiamond 12804 | ExtremeXOS 11.4 or later |
| BlackDiamond 12802 | ExtremeXOS 12.0 or later |

**Table 17: Summit Switches**

| Switch Model | Required Software |
|---|---|
| Summit X450 series | ExtremeXOS 11.3.1 or later |
| Summit X450a series | ExtremeXOS 11.3.1 or later |
| Summit X450e series | ExtremeXOS 11.3.1 or later |

For technical specifications for the LX4 XENPAK, see Technical Specifications.

# Installing and Removing a XENPAK Module

### Warning
XENPAK modules become very hot after prolonged use. Be careful when removing a XENPAK module from the chassis or option card. If the XENPAK module is too hot to touch, disengage the XENPAK module and allow it to cool before removing it completely.

This section describes installing and removing the XENPAK module (XENPAK Module). You can install or remove the XENPAK module from your Extreme Networks switch without powering off the system.

> **Note**
>
> On a Summit X450 series, X450a series, or X450e series switch, the XENPAK module is inserted into an optional module card. Although the module card is not hot-swappable, you can hot swap the XENPAK into and out of the module card on the Summit. For information about the optional module card for XENPAKs on a Summit X450 series, X450a series, or X450e series switch, see the Summit Family Switches Hardware Installation Guide.

Card edge
connector
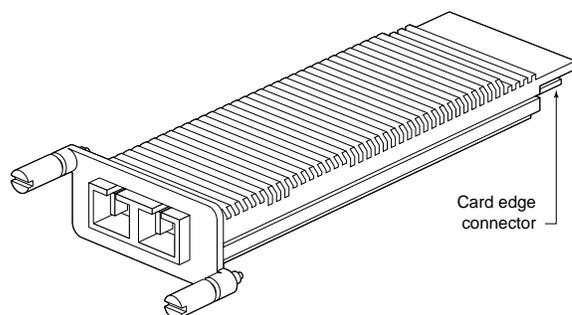
**Figure 19: XENPAK Module**

> **Warning**
>
> XENPAK modules contain Class 1 lasers. Invisible laser radiation can occur when laser connectionsareunplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10, andEN60825-1A2:2001.

> **Caution**
>
> To prevent ESD damage to the XENPAK module, always use an appropriately grounded ESD-preventive wrist strap when installing or removing the module. Handle the module by its sides only. Never touch the card-edge connectors at the insertion end of the module.

## Install a XENPAK Module

1 Remove the XENPAK module from its antistatic container and remove the dust covers from the module optical connectors.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2 Remove any dust covers from the port on the module into which you are installing the XENPAK module.

3 Holding the module by its sides, insert the XENPAK module into the slot on the I/O module or Summit option card.

4 Slide the XENPAK module as far back into the slot as possible, until you hear it click, indicating that it is firmly attached.

5 Secure the XENPAK module to the I/O module or option card by turning the two captive screws clockwise until the screws are hand-tight.

> **Note**
>
> To ensure that your XENPAK module is undamaged upon installation, you can correlate factory test data with your installation site test data by consulting the average power reference values shown on the XENPAK module test data sheet (Part No. 121074-00) enclosed with your module.

## Remove a XENPAK Module

1 Disconnect the optical cable from the XENPAK module.

> **Warning**
>
> XENPAK modules contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam.

2 Loosen the two captive screws until they are completely free from the I/O module faceplate or the Summit option card.

The captive screws remain attached to the XENPAK module.

3 Gripping both captive screws, carefully pull the XENPAK module out of the slot.

4 Place the dust covers back into the XENPAK module connectors.

5 Place the XENPAK module immediately into an antistatic container to protect it from ESD damage and dust.

# 7 Extreme Networks CFP2 modules

**CFP2 Overview**
**CFP2 Modules details**
**Installing a CFP2 Module**
**Removing a CFP2 Module**

## CFP2 Overview

Extreme Networks' CFP2 modules provides transmit and receive channels in a single pluggable optical module, for an aggregate bandwidth of 100 Gbps. CFP2 modules are used in Extreme Networks BlackDiamond switches.There are two CFP2 modules available: SR10 and LR4. The CFP2 SR10 can be used for distances up to 150 meters, while the CFP2 LR4 can be used for distances up to 10 kilometers.

You can insert or remove CFP2 modules without powering down the system.

The information in this guide about hardware platform support for CFP2 modules is current as of the date this guide was published. Support for CFP2 modules may have been added to other switches or I/O modules besides those listed in this guide. For current information about hardware support and the minimum required software for CFP2 modules, refer to the most recent version of the ExtremeXOS Hardware and Software Compatibility and Recommendations Matrices.

## CFP2 Modules details

### CFP2 SR10

The CFP2 SR10 is a ten channel pluggable, parallel, fiber optic transceiver for 100 Gigabit Ethernet applications. The transceiver supports high speed serial links over multi-mode fiber for link distances up to 100m with OM3 fiber or 150m with OM4 fiber.With an optional break-out cable, the CFP2 SR10 module can support 10 10-Gigabit data lanes. The CFP2 SR10 uses a 24-fiber MPO fiber optic connector. The CFP2 SR10 is compliant to 100GbE specifications 802.3ba (100GBase-SR10, CAUI and CPPI) up to 100m OM3 and 150m OM4 fiber. Mechanical dimensions, connecters, and footprint of the module conform to the CFP MSA CFP2 Hardware Specification Revision 1.0 July 31, 2013 standard.
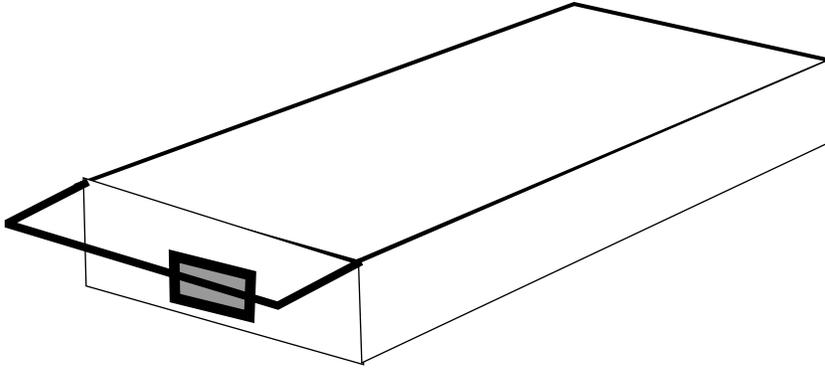
**Figure 20: CFP2 SR10 Optical Module (Bail latch Open Position)**

The CFP2 SR10 module is supported in the following Extreme Networks switches and components:

* BlackDiamond X8 switch

For technical specifications for the CFP2 SR10 module, see Technical Specifications.

## CFP2 LR4 Module

The CFP2 LR4 is an optic transceiver for 100Gbps Ethernet applications. The module supports 100 Gigabit data rate that can reach up to 10 kilometers over standard single-mode fiber (SMF, G.652). Data is transmitted using four 25 Gigabit data lanes. The CFP2 LR4 uses an LC connector. Extreme Networks' CFP2 optical module form factor, optical/electrical connection, and digital diagnostic interface are designed according to IEEE 802.3ba standards. Mechanical dimensions, connecters, and footprint of the module conform to the CFP MSA CFP2 Hardware Specification Revision 1.0 July 31, 2013 standard.
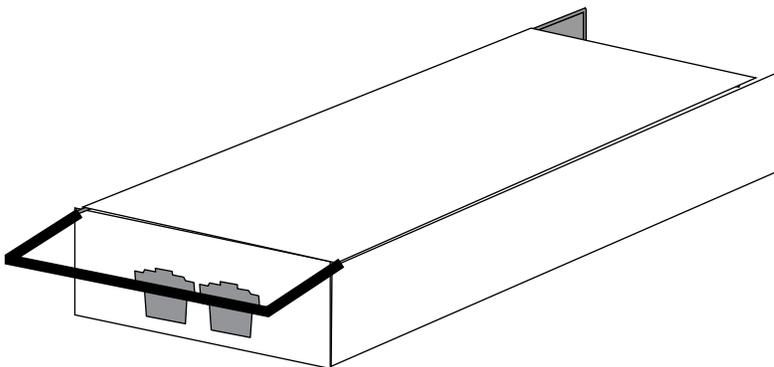


**Figure 21: CFP2 LR4 Optical Module (Bail Latch Open Position)**

The CFP2 LR4 module is supported in the following Extreme Networks switches and components:

* BlackDiamond X8 switch

For technical specifications for the CFP2 LR4 module, see Technical Specifications.

## Installing a CFP2 Module

You can install or remove CFP2 modules in your switch without powering off the system.

> **Warning**
>
> CFP2 modules contain Class 1M lasers. Invisible laser radiation can occur when laser connections areunplugged. Do not stare into the beam. This device is compliant with IEC 60825-1 Amendment 2 and CFR21Section 1040.

1  Remove the CFP2 module from its antistatic container and remove the dust covers from the module optical connector.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2  Remove any rubber dust covers from the port where you are installing the CFP2 module.

3  Holding the CFP2 module by its sides, insert the CFP2 module into the port on the switch or module. The latch handle should be in the open position, with the handle up.
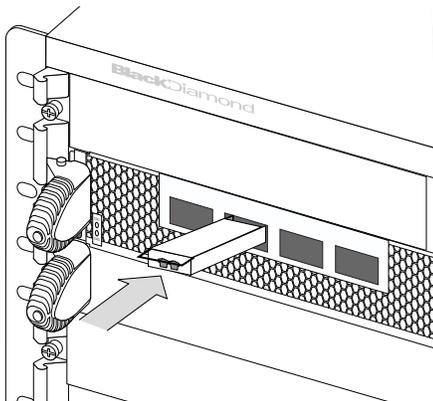


**Figure 22: Installing a CFP2 Module (CFP2 LR4 module shown)**

4  Slide the CFP2 module into the port until you hear it click into place. The front of the module should be flush against the front panel of the chassis.

5  Rotate the handle down 90 degrees to the closed position to secure the CFP2 module in the chassis. The handle should be flush against the front to the module.
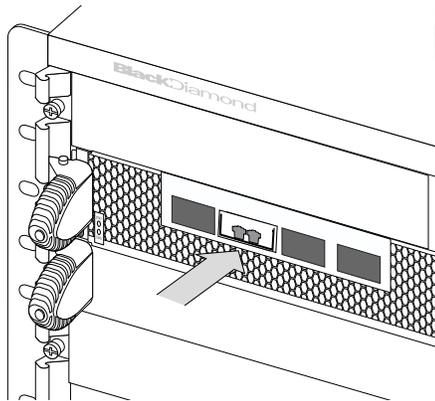


**Figure 23: Installed CFP2 Module (BlackDiamond X8 series switch)**

If you are installing only one CFP2 module, make sure that all unoccupied ports are covered with a rubber dust cover.

# Removing a CFP2 Module

You can remove a CFP2 module from your Extreme Networks switch without powering off the system.

Note

Disconnect fiber-optic cable from a CFP2 module before removing the CFP2 module from the port.

1  Rotate the handle (bail latch) on the CFP2 module upward. Be sure that you rotate the bail latch up the full 90 degrees. The open position is perpendicular to the closed position..
2  Pull the connector out of the port.

# A Safety Information

### warning

Read the following safety information thoroughly before installing Extreme Networks products. Failure to follow this safety information can lead to personal injury or damage to the equipment.

Only trained and qualified service personnel (as defined in IEC 60950-1 and AS/NZS 3260) should install, replace, or perform service to Extreme Networks switches and their components. Qualified personnel have read all related installation manuals, have the technical training and experience necessary to be aware of the hazards to which they are exposed in performing a task, and are aware of measures to minimize the danger to themselves or other persons.

## Fiber Optic Ports and Optical Safety

The following safety warnings apply to all optical devices used in Extreme Networks equipment that are removable or directly installed in an I/O module or chassis system. These devices include, but are not limited to, gigabit interface converters (GBICs); SFP optical modules (mini-GBICs) and SFP+ optical modules; QSFP+ optical modules; XENPAK transceivers; and XFP laser optic modules

### Warning

Laser optic modules become very hot after prolonged use. Take care when removing a laser optic module from the chassis or option card. If the laser optic module is too hot to touch, disengage the laser optic module and allow it to cool before removing it completely.

When working with laser optic modules, always take the precautions listed below to prevent exposure to hazardous radiation:

- Never look at the transmit LED/laser through a magnifying device while it is powered on.
- Never look directly at a fiber port on the switch or at the ends of a fiber cable when they are powered on.
- Invisible laser radiation can occur when the connectors are open. Avoid direct eye exposure to the beam when optical connections are unplugged.
- Never alter, modify, or change an optical device in any way other than suggested in this document.

# GBIC, SFP (Mini-GBIC), SFP+, QSFP+, XENPAK, and XFP Regulatory Compliance

Extreme Networks pluggable optical modules and direct-attach cables meet the following regulatory requirements.

- Class 1 or Class 1M Laser Product
- EN60825-1:2007 2nd Ed. or later, European standard
- FCC 21 CFR Chapter 1, Subchapter J in accordance with FDA & CDRH requirements
- Application of CE Mark in accordance with 2004/108/EEC EMC Directive and the 2006/95/EC Low Voltage Directives
- UL and/or CSA registered component for North America
- 47 CFR Part 15, Class A when installed into Extreme products

# Sicherheitshinweise

### Warning

Lesen Sie die folgenden Sicherheitshinweise aufmerksam durch, ehe Sie Extreme Networks-Produkte installieren. Eine Missachtung dieser Sicherheitshinweise kann zu Verletzungen oder zu einer Beschädigung des/r Geräte/s führen.

Extreme Networks-Geräte und deren Komponenten dürfen nur durch geschulte und qualifizierte Wartungstechniker (wie in IEC 60950-1 und AS/NZS 3260 definiert) installiert, ausgetauscht oder gewartet werden.

Dieses qualifizierte Personal muss den Inhalt aller zugehörigen Installationsanleitungen kennen sowie über die technische Ausbildung und Erfahrung verfügen, um die Gefahren, die mit der Ausführung einer Aufgabe assoziiert sind, zu kennen und zu wissen, wie sie diese Gefahren für sich selbst und Dritte minimieren können.

# LWL-Ports und optische Sicherheit

Folgende Sicherheitswarnung gilt für alle optischen Geräte, die in Extreme Networks-Geräten eingesetzt werden und entweder herausnehmbar sind oder direkt in einem E/A-Modul oder im Chassissystem eingebaut sind. Solche Geräte sind nicht nur Gigabit-Interface-Konverter (GBICs), steckbare Kleinformfaktormodule (SFP) (oder Mini-GBICs), QSFP+ Module, XENPAK Sendeempfänger und laseroptische XFP-Module.

### Warning

Laseroptische Module können bei längerem Gebrauch sehr heiß werden. Seien Sie beim Ausbau eines laseroptischen Moduls aus dem Modul oder der Optionskarte äußerst vorsichtig. Wenn das laseroptische Modul zum Anfassen zu heiß ist, trennen Sie das laseroptische Modul und lassen Sie es abkühlen, ehe Sie es komplett ausbauen.

Ergreifen Sie beim Arbeiten mit laseroptischen Modulen die nachfolgenden Vorsichtsmaßnahmen, um eine Aussetzung gegenüber gefährlicher Strahlung zu vermeiden.

- Blicken Sie auf keinen Fall durch ein Vergrößerungsglas in die Sendediode/den Laser, solange die Sendediode aktiv ist.
- Blicken Sie auf keinen Fall in den LWL-Port am Switch oder auf die Stirnflächen eines aktiven LWL-Kabels.
- Bei offenen Anschlüssen kann unsichtbare Laserstrahlung abgegeben werden. Vermeiden Sie eine direkte Aussetzung der Augen gegenüber dem Strahl, wenn die optischen Anschlüsse offen (ohne Stecker) sind.
- Optische Geräte dürfen auf keine andere Weise als in diesem Dokument empfohlen verändert, modifiziert oder umgebaut werden.

## Konformität von GBIC, SFP (Mini-GBIC), QSFP+, XENPAK undXFP

Steckbare optische Module von Extreme Networks und direkt angeschlossene Kabel erfüllen folgende gesetzliche Vorschriften:

- Laserprodukt der Klasse 1 oder Klasse 1M
- EN60825-1:2007 2. Ausgabe oder später, Europäische Norm
- FCC 21 CFR Kapitel 1, Paragraph J in Übereinstimmung mit FDA- und CDRH-Bestimmungen
- Anwendung des CE-Zeichens gemäß der EMV-Richtlinie 2004/108/EEC und der Niederspannungsrichtlinie 2006/95/EC
- UL und/oder CSA-geprüfte Komponente für Nordamerika
- 47 CFR Teil 15, Klasse A bei Einbau in Extreme-Produkte

# B Technical Specifications

## SFP Specifications

The SX and Industrial Grade SX SFPs conform to the 1000BASE-SX standard. SX SFP Specifications lists the specifications for the SX and SX Industrial Grade SFP interface.

### SX SFP Specifications

**Table 18: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -9.5 dBm | | -4 dBm |
| Center wavelength | 830 nm | 850 nm | 860 nm |

**Table 19: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | -17 dBm |
| Average receive power (max) | | | 0 dBm |
| Operating wavelength | 770 nm | 850 nm | 860 nm |

**Table 20: Link**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Link power budget | | | 7.5 dB |
| Operating distance | | | 550 m |

The LX and Industrial Grade LX SFPs conform to the 1000BASE-LX standard. LX SFP Specifications lists the specifications for the LX and LX Industrial Grade SFP interface.

## LX SFP Specifications

**Table 21: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -9.5 dBm | | -3 dBm |
| Center wavelength | 1270 nm | 1310 nm | 1355 nm |

**Table 22: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | -19 dBm |
| Average receive power (max) | | | -3 dBm |
| Operating wavelength | 1270 nm | 1310 nm | 1355 nm |

**Table 23: Link**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Link power budget | | | 8 dB |
| Operating distance | | | 10 km |

ZX SFP Specifications lists the specifications for the ZX SFP interface.

## ZX SFP Specifications

**Table 24: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -2 dBm | 0 dBm | 3 dBm |
| Center wavelength | 1530 nm | 1550 nm | 1570 nm |

**Table 25: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | -24 dBm |
| Average receive power (max) | | | -3 dBm |
| Operating wavelength | 1530 nm | 1550 nm | 1570 nm |
| Operating distance | | | 80 km |

1000BASE-BX Bi-directional SFP Specifications lists specifications for the 1000BASE-BX bi-directional SFPs. The 1000BASE-BX SFP modules conform to the IEEE 802.3ah 1000BASE-BX10 standard.

## 1000BASE-BX Bi-directional SFP Specifications

**Table 26: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -9 dBm | | -3 dBm |
| Center wavelength (1000BASE-BX10-D) | 1480 nm | 1490 nm | 1550 nm |
| Center wavelength (1OOOBASE-BX10-U) | 1260 nm | 1310 nm | 1360 nm |

**Table 27: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | -19 dBm |
| Average receive power (max) | | | -3 dBm |

**Table 28: Link**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Link power budget | | | 8 dB |
| Operating distance | | | 10 km |

**Note**

The 1000BX bidirectional SFPs include two SFP optical devices, the 1000BASE-BX-U SFP and the 1000BASE-BX-D SFP, which must be used as a pair to allow for a single fiber bidirectional connection.

100FX SFP (GE Ports) Specifications lists the specifications for the 100FX SFP module for Gigabit Ethernet (GE) ports. The 100FX SFP for GE ports conforms to the 100FX-MMF standard.

## 100FX SFP (GE Ports) Specifications

**Table 29: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -20 dBm | | -14 dBm |
| Center wavelength | 1270 nm | 1310 nm | 1380 nm |

**Table 30: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | -31 dBm |
| Average receive power (max) | | | -14 dBm |

**Table 31: Operating distance range over each fiber type:**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| 62.5/125 mm MMF | 2 m | | 2000 m |
| 50/125 mm MMF | 2 m | | 2000 m |

Dual-speed 100FX/1000LX SFP Specifications lists the specifications for the dual-speed 100FX/1000LX SFP module for Gigabit Ethernet (GE) ports. Operating at 100 Mbps, the dual-speed SFP conforms to the 100BASE-LX10 standard. Operating at 1000 Mbps, the dual-speed SFP conforms to the 1000BASE-LX standard.

## Dual-speed 100FX/1000LX SFP Specifications

**Table 32: Dual-speed 100FX/1000LX SFP Specifications**

| Parameter | 100FX | 1000LX |
|---|---|---|
| Average launch power range with 9 um SMF | -8 dBm to -15 dBm | -3 dBm to -11 dBm |
| Receiver power range with 9 um SMF | -8 dBm to -25 dBm | -3 dBm to -19 dBm |
| Optical link budget with 9 um SMF | 10 dB | 8 dB |
| Center wavelength range | 1270 to 1355 | 1270 to 1355 |
| Operating distance range over each optical fiber type (see note below table): | | |
| 62.5/125 µm MMF | 2 to 2000 m | 2 to 550 m |
| 50/125 µm MMF | 2 to 2000 m | 2 to 550 m |
| 9/125 µm SMF | 2 to 10,000 m | 2 to 10,000 m |

Note

The 100FX/1000LX SFP module complies with the 100FX-SMF standard. To use the 100FX/1000LX SFP module in 100FX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Next, connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

100BASE-LX10 SFP Specifications lists specifications for the LX100 SFP module.

## LX100 SFP specifications

**Table 33: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | 1 dBm | 3 dBm | 5 dBm |
| Center wavelength | 1480 nm | 1550 nm | 1580 nm |

**Table 34: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | –30 dBm |
| Average receive power | | | –9 dBm |
| Operating wavelength | 1260 nm | 1550 nm | 1580 nm |
| Operating distance | | | 100 km |

100BASE-LX10 SFP Specifications lists specifications for the 100BASE-LX10 SFP module.

## 100BASE-LX10 SFP Specifications

**Table 35: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | –15 dBm | –10 dBm | –8 dBm |
| Center wavelength | 1260 nm | 1310 nm | 1360 nm |

**Table 36: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | –25 dBm |
| Average receive power | | | –8 dBm |
| Operating wavelength | 1260 nm | 1310 nm | 1360 nm |

**Table 37: Link**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Link Power Budget | | | 10 dB |
| Operating distance | | | 10 km |

100BASE-BX Bi-directional SFP Specifications lists specifications for the 100BX Bi-directional SFPs. The 100BASE-BX SFP modules conform to the IEEE 802.3ae standard.

## 100BASE-BX Bi-directional SFP Specifications

**Table 38: Transmitter**

| Parameter | Minimum | Maximum |
|---|---|---|
| Average launch power | –14 dBm | –8 dBm |
| Center wavelength (100BASE-BX10-D) | 1480 nm | 1580 nm |
| Center wavelength (1OOBASE-BX10-U) | 1260 nm | 1360 nm |

**Table 39: Receiver**

| Parameter | Minimum | Maximum |
|---|---|---|
| Receive sensitivity | –28.2 dBm | |
| Average receive power (max) | | –8 dBm |

**Table 40: Link**

| Parameter | Minimum | Maximum |
|---|---|---|
| Link power budget | | 14.2 dB |
| Operating distance | | 10 km |

**Note**

The 100BX bidirectional SFPs include two SFP optical devices, the 100BASE-BX-U SFP and the 100BASE-BX-D SFP, which must be used as a pair to allow for a single fiber bidirectional connection.

100FX SFP (GE Ports) Specifications lists the specifications for the 100BASE-FX SFP module for fast Ethernet (FE) ports.

## 100BASE-FX SFP for FE Ports Specifications

**Table 41: Transmitter**

| Parameter | Minimum | Maximum |
|---|---|---|
| Average launch power | -20 dBm | -14 dBm |
| Center wavelength | 1270 nm | 1380 nm |

**Table 42: Receiver**

| Parameter | Minimum | Maximum |
|---|---|---|
| Receive sensitivity | -31 dBm | |
| Average receive power (max) | | -14 dBm |

**Table 43: Operating distance range over each fiber type:**

| Parameter | Minimum | Maximum |
|---|---|---|
| 62.5/125 mm MMF | 2 m | 2000 m |
| 50/125 mm MMF | 2 m | 2000 m |

10/100/1000BASE-T Copper SFP Specifications lists specifications for the 10/100/1000BASE-T copper SFP module. The 10/100/1000BASE-T copper SFP module is compatible with the Gigabit Ethernet standard and 1000Base-T standard as specified in the IEEE 802.3ab standard.

## 10/100/1000BASE-T Copper SFP Specifications

**Table 44: 10/100/1000BASE-T Copper SFP Specifications**

| Parameter | Value |
|---|---|
| Supply current | 375 mA maximum |
| Link distance for each speed | |
| 1 Gbps | 100 m using Cat5 cable |
| 100 Mbps | 150 m using Cat5 cable |
| 10 Mbps | 250 m using Cat5 cable |

# SFP+ Specifications

The SR SFP+ module conforms to the 10GBASE-SR standard.

## SR SFP+ Specifications

**Table 45: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -7.3 dBm | | -1 dBm |
| Center wavelength | 840 nm | 850 nm | 860 nm |

**Table 46: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receive sensitivity | | | -11 dBm |
| Average receive power (max) | | | -1 dBm |
| Operating wavelength | 840 nm | 850 nm | 860 nm |

**Table 47: Link**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Link power budget | | | 7.5 dB |

**Table 48: Operating distance range (depends on type and modal bandwidth):**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| 62.5 mm MMF (160 MHz*km)<br>62.5 mm MMF (200 MHz*km)<br>50 mm MMF (400 MHz*km)<br>50 mm MMF (500 MHz*km)<br>50 mm MMF (2000 MHz*km) | | | 26 m<br>33 m<br>66 m<br>82 m<br>300 m |

LR SFP+ Specifications lists the specifications for the LR SFP+ module. The LR SFP+ module conforms to the 10GBASE-LR standard.

## LR SFP+ Specifications

**Table 49: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -8.2 dBm | | 0.5 dBm |
| Center wavelength | 1260 nm | 1310 nm | 1355 nm |

**Table 50: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receive power (max) | –14.4 dBm | | –1 dBm |
| Center wavelength | 1260 nm | 1310 nm | 1355 nm |
| Maximum receiver sensitivity in OMA | | | –12.6 dBm |
| Operating distance | | | 10 km |

ER SFP+ Specifications lists the specifications for the ER SFP+ module. The ER SFP+ module conforms to the 10GBASE-ER standard.

## ER SFP+ Specifications

**Table 51: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | | | 4 dBm |
| Center wavelength | 1530 nm | 1550 nm | 1565 nm |

**Table 52: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receive power (max) | –15.8 dBm | | –1 dBm |
| Center wavelength | 1530 nm | 1550 nm | 1565 nm |
| Maximum receiver sensitivity in OMA | | | –14.1 dBm[1] |
| Operating distance | | | 40 km |

LRM SFP+ Specifications lists specifications for the LRM SFP+ module. The LRM SFP+ module conforms to the 10GBASE-LRM standard

## LRM SFP+ Specifications

**Table 53: Transmitter**

| Parameter | Minimum | Maximum |
|---|---|---|
| Average launch power | –6.5 dBM | 0.5 dBm |
| Center wavelength | 1260 nm | 1355 nm |

**Table 54: Receiver**

| Parameter | Minimum | Maximum |
|---|---|---|
| Average receive power (max) | –6.5 dBm | 0.5 dBm |
| Center wavelength | 1260 nm | 1355 nm |
| Maximum receiver sensitivity in OMA | | 1.5 dBm |
| Operating distance | | 220 m |

## ZR SFP+ Specifications

**Table 55: ZR SFP+ Specifications**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | –2 dBm | 0 | 3 dBm |
| Center wavelength | 1530 nm | 1550 nm | 1570nm |
| Receiver sensitivity in OMA | | | –24 dBm |
| Average Recieve Power (max) | | | -3 dBm |
| Operating Wavelenghth | 1530 | 1550 | 1570 |
| Operating Distance | | | 80 km |

---

[1]  OMA=10log10[2P{(A-1)/(A+1)}], A = 10(Er/10), P = 10(Pf/10)

# QSFP+ Specifications

The following lists the specifications for the SR4 QSFP+ module. The SR4 QSFP+ module conforms to the 802.3ba D3.2 (40GBASE-SR4) standard.

This module is a Class 1M laser device.

## SR4 QSFP+ Specifications

**Table 56: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power, each lane | -7.6 dBm | | 2.4 dBm |
| Center wavelength | 840 nm | 850 nm | 860 nm |

**Table 57: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Stressed receiver sensitivity in OMA, each lane | | | -5.4 dBm |
| Average receive power (max), each lane | -9.5 dBm | | 2.4 dBm |
| Operating wavelength | 840 nm | 850 nm | 860 nm |

**Table 58: Link**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Link power budget | 1.9 dB | | 10 dB |

**Table 59: Operating distance over each fiber type:**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| OM3 fiber<br>OM4 fiber | | | 100 m<br>150 m |

## LR4 QSFP+Specifications

**Table 60: LR4 QSFP+ Specifications**

| Parameter | Minimum | Maximum |
|---|---|---|
| Transmitter | | |
| Average launch power, each lane | -7.0 dBm | 2.3 dBm |
| Center wavelength | 1264.5 nm | 1277.5 nm |
| | 1284.5 nm | 1297.5 nm |
| | 1304.5 nm | 1317.5 nm |

**Table 60: LR4 QSFP+ Specifications (continued)**

| | 1324.5 nm | 1337.5 nm |
|---|---|---|
| **Receiver** | | |
| Stressed receiver sensitivity in OMA, each lane | | -11.5 dBm |
| Average receive power each lane | 2.3 dBm | -13.7 dBm |
| Operating wavelength | 1264.5 nm | 1277.5 nm |
| | 1284.5 nm | 1297.5 nm |
| | 1304.5 nm | 1317.5nm |
| | 1324.5 nm | 1337.5 nm |
| Link | | |
| Link power budget | | 6.7 dB |
| Operating distance: | | |
| SMF (single mode fiber) | | 10 km |

# XFP Specifications

The following lists the specifications for the LR XFP module.

## LR XFP Module Specifications

**Table 61: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -8.2 dBm | | 0.5 dBm |
| Center wavelength | 1260 nm | 1310 nm | 1355 nm |

**Table 62: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receiver power (max) | | | 0.5 dBm |
| Center wavelength | 1260 nm | 1310 nm | 1355 nm |
| Stressed receiver sensitivity in OMA | | | -10.3 dBm 0.093 mW [2] |
| Operating distance | | | 10 km |

ER XFP Module Specifications lists specifications for the ER XFP module.

---

[2]  OMA=10log10[2P{(A-1)/(A+1)}], A = 10(Er/10), P = 10(Pf/10)

## ER XFP Module Specifications

**Table 63: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | –4.7 dBm | | 4 dBm |
| Center wavelength | 1530 nm | | 1565 nm |

**Table 64: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receiver power (max) | –11.8 dBm | | –1 dBm |
| Center wavelength | 1260 nm | | 1580 nm |
| Maximum receiver sensitivity in OMA | | | 14.1 dBm[3] |
| Operating distance | | | 40 km |

SR XFP Module Specifications lists specifications for the SR XFP module.

## SR XFP Module Specifications

**Table 65: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -7.3 dBm | | –1.3 dBm |
| Center wavelength | 840 nm | 850 nm | 860 nm |

**Table 66: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receiver power (max) | –9.9 dBm | | –1 dBm |
| Center wavelength | 840 nm | | 860 nm |
| Maximum receiver sensitivity in OMA | | | -11.1 dBm[4] |
| Operating distance | | | 300 m |

---

[3] OMA=10log10[2P{(A-1)/(A+1)}], A = 10(Er/10), P = 10(Pf/10)
[4] OMA=10log10[2P{(A-1)/(A+1)}], A = 10(Er/10), P = 10(Pf/10)

**Table 67: Operating distance range (depends on type and modal bandwidth)**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| 62.5 mm MMF (160 MHz*km)<br>62.5 mm MMF (200 MHz*km)<br>50 mm MMF (400 MHz*km)<br>50 mm MMF (500 MHz*km)<br>50 mm MMF (2000 MHz*km) | | | 26 m<br>33 m<br>66 m<br>82 m<br>300 m |

ZR XFP Module Specifications lists specifications for the ZR XFP module.

## ZR XFP Module Specifications

**Table 68: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | 0.5 dBm | 2 dBm | 4 dBm |
| Center wavelength | 1530 nm | 1550 nm | 1565 nm |

**Table 69: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receiver power (max) | | | –7 dBm |
| Center wavelength | | 1550 nm | |
| Receiver sensitivity | –24 dBm | | |
| Operating distance | | | 80 km |

Tunable DWDM XFP Module Specifications lists specifications for the tunable DWDM XFP module. TX Wavelengths and Channel Assignments for the Tunable DWDM XFP lists the transmitter center wavelength associated with each configurable channel on the tunable DWDM module.

## Tunable DWDM XFP Module Specifications

**Table 70: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | –1 dBm | | 3 dBm |
| Center wavelength | | See TX Wavelengths and Channel Assignments for the Tunable DWDM XFP | |

**Table 71: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receiver power (max) | | | –7 dBm |
| Center wavelength | 1260 nm | | 1600 nm |
| Receiver sensitivity | –24 dBm | | |
| Operating distance | | | 80 km |

**Table 72: TX Wavelengths and Channel Assignments for the Tunable DWDM XFP**

| TX Wavelength | Channel | TX Wavelength | Channel | TX Wavelength | Channel | TX Wavelength | Channel |
|---|---|---|---|---|---|---|---|
| 1568.77 nm | 11 | 1558.17 nm | 24 | 1547.72 nm | 37 | 1537.40 nm | 50 |
| 1568.36 nm | 1150 | 1557.77 nm | 2450 | 1547.32 nm | 3750 | 1537.00 nm | 5050 |
| 1567.95 nm | 12 | 1557.36 nm | 25 | 1546.92 nm | 38 | 1536.61 nm | 51 |
| 1567.54 nm | 1250 | 1556.96 nm | 2550 | 1546.52 nm | 3850 | 1536.22 nm | 5150 |
| 1567.13 nm | 13 | 1556.55 nm | 26 | 1546.12 nm | 39 | 1535.82 nm | 52 |
| 1566.72 nm | 1350 | 1556.15 nm | 2650 | 1545.72 nm | 3950 | 1535.43 nm | 5250 |
| 1566.31 nm | 14 | 1555.75 nm | 27 | 1545.32 nm | 40 | 1535.04 nm | 53 |
| 1565.90 nm | 1450 | 1555.34 nm | 2750 | 1544.92 nm | 4050 | 1534.64 nm | 5350 |
| 1565.50 nm | 15 | 1554.94 nm | 28 | 1544.53 nm | 41 | 1534.25 nm | 54 |
| 1565.09 nm | 1550 | 1554.54 nm | 2850 | 1544.13 nm | 4150 | 1533.86 nm | 5450 |
| 1564.68 nm | 16 | 1554.13 nm | 29 | 1543.73 nm | 42 | 1533.47 nm | 55 |
| 1564.27 nm | 1650 | 1553.73 nm | 2950 | 1543.33 nm | 4250 | 1533.07 nm | 5550 |
| 1563.86 nm | 17 | 1553.33 nm | 30 | 1542.94 nm | 43 | 1532.68 nm | 56 |
| 1563.45 nm | 1750 | 1552.93 nm | 3050 | 1542.54 nm | 4350 | 1532.29 nm | 5650 |
| 1563.05 nm | 18 | 1552.52 nm | 31 | 1542.14 nm | 44 | 1531.90 nm | 57 |
| 1562.64 nm | 1850 | 1552.12 nm | 3150 | 1541.75 nm | 4450 | 1531.51 nm | 5750 |
| 1562.23 nm | 19 | 1551.72 nm | 32 | 1541.35 nm | 45 | 1531.12 nm | 58 |
| 1561.83 nm | 1950 | 1551.32 nm | 3250 | 1540.95 nm | 4550 | 1530.72 nm | 5850 |
| 1561.42 nm | 20 | 1550.92 nm | 33 | 1540.56 nm | 46 | 1530.33 nm | 59 |
| 1561.01 nm | 2050 | 1550.52 nm | 3350 | 1540.16 nm | 4650 | 1529.94 nm | 5950 |
| 1560.61 nm | 21 | 1550.12 nm | 34 | 1539.77 nm | 47 | 1529.55 nm | 60 |
| 1560.20 nm | 2150 | 1549.72 nm | 3450 | 1539.37 nm | 4750 | 1529.16 nm | 6050 |
| 1559.79 nm | 22 | 1549.32 nm | 35 | 1538.98 nm | 48 | 1528.77 nm | 61 |
| 1559.39 nm | 2250 | 1548.91 nm | 3550 | 1538.58 nm | 4850 | 1528.38 nm | 6150 |
| 1558.98 nm | 23 | 1548.51 nm | 36 | 1538.19 nm | 49 | | |
| 1558.58 nm | 2350 | 1548.11 nm | 3650 | 1537.79 nm | 4950 | | |

# XENPAK Specifications

The following lists specifications for the SR XENPAK module:

## SR XENPAK Module Specifications

**Table 73: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power | -7.3 dBm | | –1.3 dBm |
| Center wavelength | 840 nm | 850 nm | 860 nm |

**Table 74: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average receiver power (max) | –9.9 dBm | | –1 dBm |
| Center wavelength | 840 nm | | 860 nm |
| Maximum receiver sensitivity in OMA | | | -11.1 dBm [5] |
| Operating distance | | | 300 m |

**Table 75: Operating distance range (depends on type and modal bandwidth)**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| 62.5 mm MMF (160 MHz*km)<br>62.5 mm MMF (200 MHz*km)<br>50 mm MMF (400 MHz*km)<br>50 mm MMF (500 MHz*km)<br>50 mm MMF (2000 MHz*km) | | | 26 m<br>33 m<br>66 m<br>82 m<br>300 m |

**Note**

The launch power (measured using the average power method used by power meters) is measured at the factory. The average launch power minimum value is provided as a reference, not a pass/fail criterion.

lists specifications for the LR XENPAK module.

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[5] OMA=10log10[2P{(A-1)/(A+1)}], A = 10(Er/10), P = 10(Pf/10)

## LR XENPAK Module Specifications

**Table 76: Transmitter**

| Parameter | Minimum | | Maximum |
|---|---|---|---|
| Average launch power | -8.2 dBm | | 0.5 dBm |
| Center wavelength | 1260 nm | 1310 nm | 1355 nm |

**Table 77: Receiver**

| Parameter | Minimum | | Maximum |
|---|---|---|---|
| Average receiver power (max) | | | 0.5 dBm |
| Center wavelength | 1260 nm | 1310 nm | 1355 nm |
| Stressed receiver sensitivity in OMA | | | -10.3 dBm 0.093 mW [6] |
| Operating distance | | | 10 km |

ER XENPAK Module Specifications lists specifications for the ER XENPAK module.

**Table 78: ER XENPAK Module Specifications**

| Parameter | Minimum | Maximum |
|---|---|---|
| Average launch power | -4.7 dBm | 4.0 dBm |
| Optical link budget | | 10.9 dB |
| Wavelength range | 1530 nm | 1565 nm |
| Distance range: 5 dBm attentuation | 2 m | 40 km |
| Maximum receiver sensitivity in OMA | | -14.1 dBm |

**Note**

The launch power (measured using the average power method used by power meters) is measured at the factory. The average launch power minimum value is provided as a reference, not a pass/fail criterion.

ZR XENPAK Module Specifications lists specifications for the ZR XENPAK module.

---

[6]  OMA=10log10[2P{(A-1)/(A+1)}], A = 10(Er/10), P = 10(Pf/10)

## ZR XENPAK Module Specifications

**Table 79: Transmitter**

| Parameter | Minimum | Maximum |
|---|---|---|
| Optical output power | 0 dBm | 4 dBm |
| Center wavelength | 1530 nm | 1565 nm |

**Table 80: Receiver**

| Parameter | Minimum | Maximum |
|---|---|---|
| Optical input power | -22 dBm | -7 dBm |
| Operating wavelength | 1530 nm | 1565 nm |

**Table 81: General**

| Parameter | Minimum | Maximum |
|---|---|---|
| Optical link loss | 11 dB | 22 dB |
| Optical dispersion | 0 ps/nm | 1600 ps/nm |
| Operating distance | | 80 km |

**warning**

To prevent permanent damage to the ZR XENPAK and other equipment: always check the optical input power of the receiver before inserting the fiber. The maximum optical input power for the receiver is -7 dBm. If you use optical loopback for diagnostics purposes, the loopback requires a minimum of 10 dB optical attenuation. The recommended attenuation range is 10 dB to 15 dB.

LX4 XENPAK Module Specifications lists specifications for the LX4 XENPAK module.

## LX4 XENPAK Module Specifications

**Table 82: Transmitter**

| Parameter | Minimum | Maximum |
|---|---|---|
| Average launch power, 4 lanes | | + 5.5 dBm |
| Average launch power, per lane | | - 0.5 dBm |
| Optical modulation amplitude (OMA), per lane: | | |
| SMF | - 6.25 dBm | - 1.25 dBm |
| MMF | - 6.75 dBm | - 1.25 dBm |

**Table 83: Receiver**

| Parameter | Minimum | Maximum |
|---|---|---|
| Average receive power, 4 lanes | | + 5.5 dBm |
| Average receive power, per lane | | - 0.5 dBm |
| Receive sensitivity (OMA), per lane | | - 14.45 dBm |

**Table 84: Optical link budget**

| Parameter | Minimum | Maximum |
|---|---|---|
| Wavelength range | 1269.0 nm<br>1293.5 nm<br>1318.0 nm<br>1342.5 nm | 1282.4 nm<br>1306.9 nm<br>1331.4 nm<br>1355.9 nm |

**Table 85: Operating distance range:**

| Parameter | Minimum | Maximum |
|---|---|---|
| SMF | | 10 km |
| MMF | | 300 m |

LW XENPAK Module Specifications lists specifications for the LW XENPAK module.

## LW XENPAK Module Specifications

**Table 86: Transmitter**

| Parameter | Measurement |
|---|---|
| Signaling speed (nominal) | 9.95328 GBd |
| Signaling speed variation from nominal (max) | +/-20 ppm |
| Center wavelength (range) | 1260 to 1355 nm |
| Average launch power (max) | 0.5 dBm |
| Average launch power (min) | -8.2 dBm |

**Table 87: Receiver**

| Parameter | Measurement |
|---|---|
| Center wavelength (range) | 1260 to 1600 nm |
| Average receive power (max) | 0.5 dBm |
| Average receive power (min) | -14.4 dBm |

**Table 87: Receiver (continued)**

| Parameter | Measurement |
|---|---|
| Receive sensitivity (max) in OMA | 0.055 (-12.6) uW/dBm |
| Operating distance | 10 Km |

**Caution**

The maximum input power (average receive power) should be less than 0.5 dBm)

# CFP2 Specifications

The following lists the specifications for CFP2 modules.

There are two CFP2 modules:

- SR10
- LR4

These modules are Class 1M laser devices.

## CFP2 SR10 Specifications

**Table 88: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average launch power, each lane | -6.5 dBm | - | 4.0 dBm |
| Center wavelength | 840 nm | - | 860 nm |

**Table 89: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Stressed receiver sensitivity in OMA, each lane | -5.4 dBm | - | - |
| Average receive power (max), each lane | -9.5 dBm | - | 2.4 dBm |
| Operating wavelength | 840 nm | - | 860 nm |

**Table 90: Operating distance over each fiber type:**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| OM3 fiber<br>OM4 fiber | | | 100 m<br>150 m |

## CFP2 LR4 Specifications

**Table 91: Transmitter**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Average Output Power in OMA | -1.3 dBm | | 4.5 dBm |
| Center wavelength | 1295 nm | | 1310 nm |

**Table 92: Receiver**

| Parameter | Minimum | Typical | Maximum |
|---|---|---|---|
| Receiver sensitivity in OMA | -8.6 dBm | | 4.5 dBm |
| Average receive power (max), each lane | | | 4.5 dBm |
| Operating wavelength | 1295 nm | | 1310 nm |